A BENCHMARK FOR IMPACT ASSESSMENT OF AFFORDABLE HOUSING

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ABSTRACT

There is a growing recognition in the built environment for the significance of benchmarking. It is recognized as a key driver for measuring success criteria in the built environment sector. In spite of the huge application of this technique to the sector and other sectors, very little is known of it in affordable housing sub-sector and where it has been used, components of housing quality were not holistically considered.

This study considers this identified deficiency in developing a benchmark for assessing affordable housing quality impact factors. As part of this study, samples of 4 affordable Housing projects were examined. Two each were originally selected from under 5 categories of 'operational quality standards' within United Kingdom. Samples of 10 projects were extracted from a total of 80 identified UK affordable housing projects. Investigative study was conducted on these projects showing varying impact factors and constituent parameters responsible for their quality.

Identified impact criteria found on these projects were mapped against a unifying set standard and weighted with 'relative importance index'. Adopting quality function deployment (QFD) technique, a quality matrix was developed from these quality standards groupings with their impact factors.

An affordable housing quality benchmark and a relative toolkit evolved from resultant quality matrix of project case studies and questionnaire served on

practitioners' performance. Whereas the toolkit was empirically tested for reliability and construct validity, the benchmark was subjected to refinement with the use of project case study.

Acknowledgement

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Dedication

This whole research is dedicated to the glory of Almighty God, from whom all good things originate and who made it possible for the use of all acknowledged persons as viable instrument for successful realization of this research.

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LIST OF ABBREVIATIONS/ACRONYMS

AH	*Affordable Housing*
AHQB	*Affordable Housing Quality Benchmark*
BIS	*Business Innovation and Skill*
BQA	*British Quality Award*
BQF	*British Quality Foundation*
BVPI	*Best Value Performance Indicator*
CABE	*Commission for Architecture and Built Environment*
CAPS	*Construction Accredited Performance Schemes*
CIC	*Construction Industry Council*
CIRIA	*Construction Industry Research and Information Association*
CPI	*Consumer Price Index*
CSF	*Critical Success Factor*
DQI	*Design Quality Indicator*
DTI	*Department Of Trade and Industries*
DTLGR	*Department for Trade Local Government and the Regions*
EFQM	*European Foundation of Quality Management*
EFQM	*European Foundation Quality Management*
EQA	*European Quality Award*
HBF	*Home Builders Federation*
HC	*Housing Corporation*
HQI	*Housing Quality Indicator*
HUD	*Housing and Urban Development*
KPI	*Key Performance Indicator*
KPO	*Key Performance Outcome*
KWLS	*Key Worker Living Programme*
LA	*Local Authority*
LHA	*Local Housing Authority*
L-N-A	*Large Nested Analysis*

NAHP	*National Affordable Housing Programme*
NHC	*National Housing Corporation*
NHF	*National Housing Federation*
NPIAH	*New Partnerships in Affordable Housing*
ODPM	*Office of the Deputy Prime Minister*
PMS	*Performance Measurement System*
PPG	*Planning Policy Guidance*
QIS	*Quality Index Score*
QS	*Quality Standard*
RADAR	*Results, Approach, Deployment, Assessment and Review*
RIBA	*Royal Institute of British Architects*
RSL	*Registered Social Landlord*
S106	*Section 106 of Town and Country*
SED	*Sequential Exploratory Design*
SDS	*Schemes Development Standard*
SHG	*Social Housing Grant*
S-N-A	*Small Nested Analysis*
SPD	*Supplementary Planning Document*
SPG	*Supplementary Planning Guide*
TQM	*Total Quality Management Value Management*

CHAPTER 1

1.0 GENERAL INTRODUCTION

1.1 DEVELOPMENT OF UK AFFORDABLE HOUSING

The United Kingdom has some areas that are experiencing rapid population growth and others experiencing a decline. One of such areas where the population is rising swiftly is the Greater South East region, which includes London. According to projections by the Greater London Authority (2006), London will add 711,000 people and 307,000 households between 2001 and 2016. Such projections have prompted a debate about how to accommodate 200,000 additional homes across the Greater South East above current planning targets up to 2016, i.e. where to locate new housing, and how to match jobs with the new population. Areas in the South East of England such as the Thames Gateway, Milton Keynes, South Midlands and London/ Stansted/ Cambridge/ Peterborough sub-regions are seen as opportunity areas where development, including housing, will be vital to sustaining the region's economic success and also accommodate population drift effect from the neighbouring London mega-city. To a limited extent these issues are applicable to other cities and urban areas in the United Kingdom.

While there are signs that the migratory drift of people to the south is beginning to reverse itself, demand for more housing remains an issue. In contrast, demand for housing is relatively low in cities in the North and Midlands, including parts of Liverpool, Manchester, and urban areas in the West Midlands (Bate et al., 2000).

Challenges similar to those faced in London exist in Scotland, with Edinburgh facing growth pressures, and Glasgow and Wales needing to address regeneration challenges. So shortage of housing is more prominent in some locations.

General inflation and historically low interest rates have fuelled higher housing prices, but because wage increases have not kept up with those higher prices, more and more people are being priced out of the housing market. In England, the house price to average earnings ratio declined from a peak of 5.84 in July 2007 to an estimated 4.42 in February 2009, representing a fall of 4.0 and this decline continues (Halifax, 2009). Between 1997 and 2005, the average house price in England rose 156 percent while earnings rose just 35 percent. Prolonged high demand for housing has not still resulted in any major sustained increase in supply. This is largely because of the decline in the economy, making it difficult for government to match increasing demand with required supply. The waiting lists for social housing in England grew dramatically-nearly 60 percent in five years, from 1.04 million households in 2001 to 1.63 million in 2006 (Wilson and Anseau, 2006). Figure 1.1 shows the performance of UK house prices for the period between February 2008 and February 2009. This indicates how house prices have gone up and remained high without any remarkable improvement within the period.

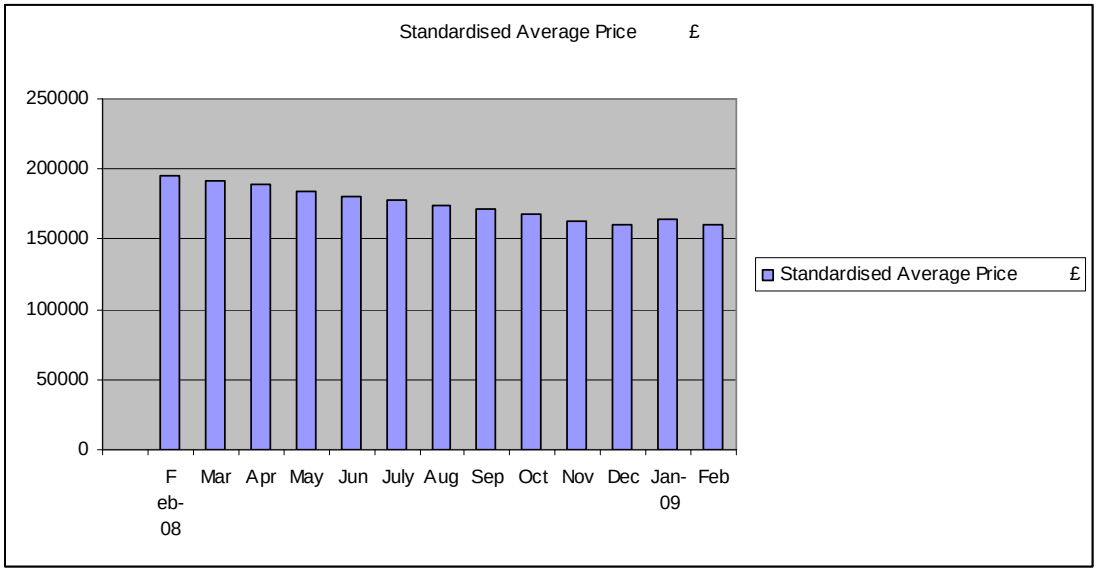

Figure 1.1: UK House Prices (adopted from Halifax, 2009)

England needs to build 70,000 new affordable homes a year, of which 50,000 should be for rent and 20,000 for purchase at an affordable price, according to government data (Wilson and Anseau, 2006). However, fewer than 40,000 new affordable housing units were built in 2005–2006. Both the labour market and the economy are pushing up housing demand, particularly in the most dynamic regions such as London.

1.2 RESEARCH QUESTIONS

Research questions typically include a central question and several sub-questions. These sub-questions are made to revolve around the main question. They streamline the purpose statement into specific questions and predictions that are usually examined later in the study. The research questions to be considered in this study are:

- How could a customised benchmark framework be designed to measure quality performance of affordable housing in UK?

- How effective could a strategy using a Key Performance Indicator (KPI) template be adopted in developing a benchmark model for affordable housing in the UK?

- How will a collaborative and comprehensive toolkit that measures technological, economical, sociological and environmental impacts be developed to satisfy users' needs for the delivery of quality Affordable housing in the UK?

- How could the intended research output be made to consolidate on previously established research findings while addressing key areas of affordable housing delivery in UK?

1.3 AIM AND OBJECTIVES

The aim of the research is to provide a comprehensive benchmark for incremental change in affordable housing quality. This study has eight objectives are:

- To identify and map out UK affordable housing schemes under their respective influencing quality standards; developers and quality parameters with a view to selecting project samples for in-depth study.

- To select samples of award winning affordable housing schemes and also conduct Questionnaire survey on their developers to gain insight on corresponding actions they adopted for their qualities.

- To conduct in-depth studies on the selected samples of award winning UK affordable housing schemes focusing on aggregating their quality variables under outlined corresponding impact factors.

- To investigate existing relationships between relevant UK quality standards' (parameters and criteria) relative to outlined impact factors to be able to identify areas of deficiency.

- To investigate various relevant built environment toolkits, Key Performance Indicators and Benchmark models to conceptualize affordable housing model.

- To develop affordable housing quality toolkit and benchmark model.

- To conduct refinement test on resultant affordable housing quality toolkit and benchmark model with recommendation for systematic approach to effective implementation on some UK affordable housing.

- To validate benchmark model by assessment of existing sampled affordable housing schemes.

Figure 1.2 shows how the objectives are linked to approaches and techniques adopted in this study for achieving the research output.

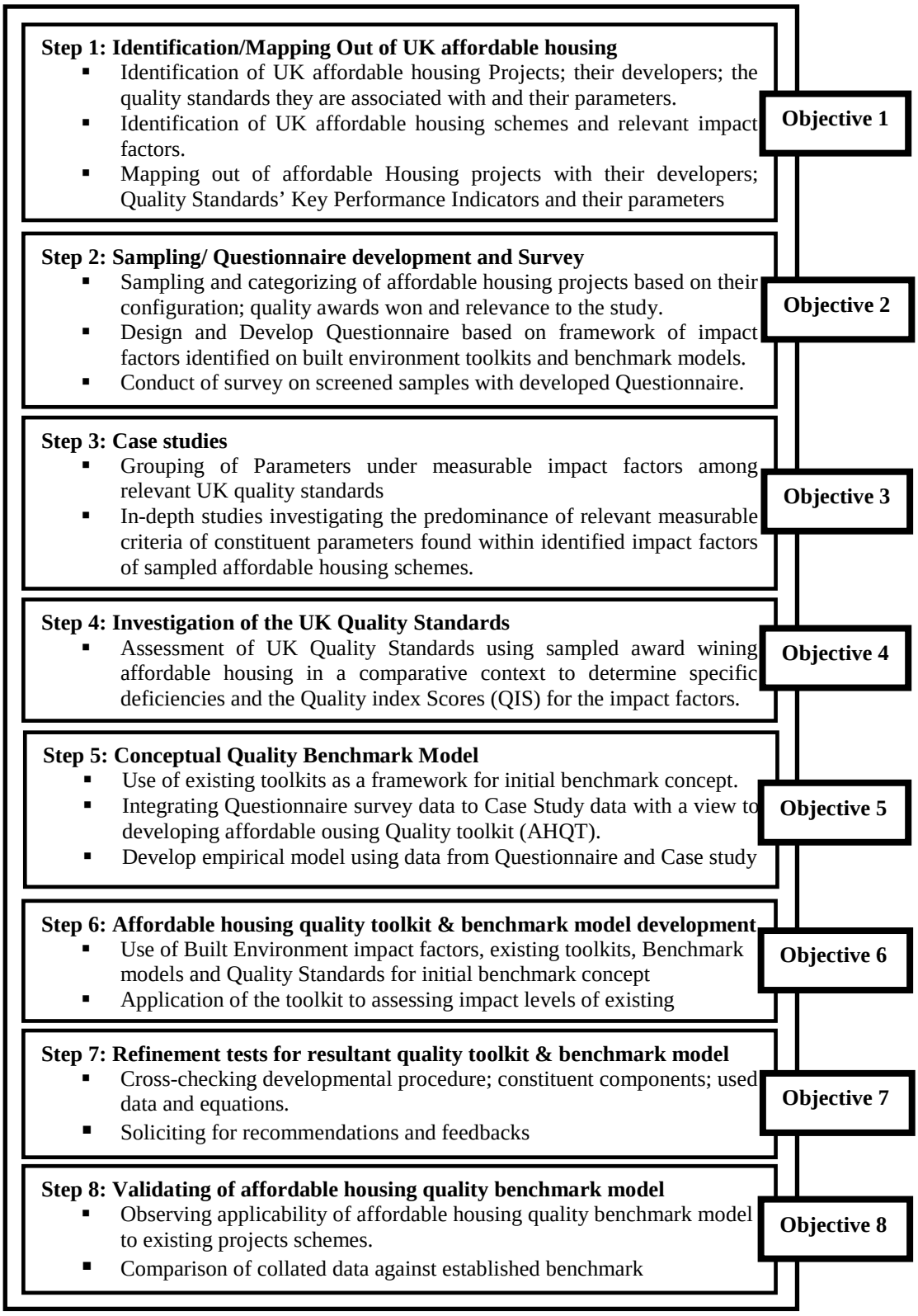

Figure 1.2 Outlines of Research Approach and Objectives

1.4 JUSTIFICATION FOR THE RESEARCH

Presently in England, the use of (former Department of Trade and Industry) now Business Innovation and Skill-Key Performance Indicators (BIS-KPI) has been widely accepted for performance measurement in the built environment, though its usage is not high in the Affordable Housing sector. The positive impact of KPI, in improving efficiency in the construction industry has been widely acknowledged and strongly recommended by experts. Nevertheless, the strength of its usage has been predominantly identified from one organisation to another or within each organization, internally. Evidence shows remarkable improvement in quality of buildings that it has been applied to in the past of buildings. (CIC, 2004) outlined typical examples of positive impact of the Design Quality Indicator (DQI) toolkit as demonstrated in the following projects:

- The National Assembly for Wales
- The British Library Centre for Conservation
- Newcastle PFI School
- Parliament Hill School
- Doha and Chennai Embassies
- Peckham Pulse Health Living Centre
- Darlaston Swimming Pool

Constructing Excellence; Building Research Establishment (BRE); Commission for Architecture and the Built Environment (CABE) and other concerned organizations in the UK built environment sector have been making constant advancement in the design of KPI'S and benchmarking toolkits for the

construction industry. These developments are specifically focussing on performance improvement on construction products, processes and also the overall impact of these activities on the built environment.

A critically investigation of the application of these UK built environment toolkits, presented gross limitation in using them to thoroughly assessing impacts of affordable housing in the area of: cost effectiveness; energy efficiency; delivery process and material application. The limitation negatively impact on the quality of various schemes. There is a need for a research which will respond to this need and complement the deficiency of the toolkit(s) limitations. This was done by extensively highlighting the functions of various toolkits, then customizing toolkit design to suit affordable housing quality demand. This study significantly balances whole life cost of a scheme within the context of acceptable quality standard, which is indispensable in improving the quality of affordable housing delivery in the UK. This balance will add value to the benefit of affordable housing clients.

RIBA (2003) recommended the need for a coherent National Planning Strategy in the affordable housing sub sector. Earlier in the 1990's there was an emphasis on collaboration between public, private actors and 'enabling strategy'. The World Bank defined enabling framework with recommendations for its implementation through constant monitoring of the housing situation to readjust policies, programs and projects (World Bank, 1990; UNCHS, 1992). Therefore, the need for the present study was strengthened by developing a monitoring toolkit using existing Business Innovation and Skill (BIS) toolkits as a reference point. So many

toolkits for benchmarking were identified in the UK built environment sector. Some of these toolkits range from: Design Quality Indicators (DQI); Housing Quality Indicators (HQI); Off-site housing toolkit to Best Value Housing Performance Indicators (BVPI). They were all designed after the purpose and intents for which they were intended to serve, thus necessitating the relevant Key Performance Indicators (K.P.I.) as focused by their designers.

A detailed investigation of the configuration of the toolkits vis-à-vis their functions present critical limitation requiring improvement, especially in a key sub-sector like affordable housing quality. This sub-sector constituting a substantial proportion of the UK housing stock is highly significant and indispensable, hence, the need for the continuous performance improvement of quality to ensure optimised output. However, to effectively address this, this study is focused on:: economical, sociological, technological, and environmental key impact factors. Through proper identification of the criteria responsible for quality improvement in affordable housing, the study is poised to fill the gap created by the limitation of the existing tools and benchmark models. Consequently, part of the output of this study is dedicated to customizing affordable housing quality toolkit while adapting Business Innovative and Skill (BIS) Key Performance Indicator (K.P.I.) template. This toolkit is useful for quality impact assessment for UK affordable housing, particularly benchmark development.

1.5 OUTLINE OF RESEARCH METHODOLOGY

Samples of affordable housing were drawn from identified UK affordable housing. Thereafter, questionnaire was developed and survey conducted to collect data from the samples. When the data collected from these samples were analyzed, it revealed pre-disposing factors of quality dimensions of the samples. A complementary study on some of these samples further revealed in-depth traces of quality dimensions of affordable housing. Finally, an integration of the outcome of both analyses with a confirmatory holistic analysis resulted in affordable housing benchmark model. This model was validated with data from two existing affordable housing projects.

1.6 OUTLINE OF THESIS CHAPTERS

This thesis consists of 9 chapters. The first chapter, the introduction, presents an overview of the study, i.e.: the research background; problem; methodology; questions; framework; the strategy; aim; objectives and outcome. Also included in the chapter are justification of the research; outline of the thesis chapters, scope and limitation of the research.

Chapter 2 provides a review of affordable housing and relevant built environment benchmark models. It also outlines various types of affordable houses in UK, as well as the key impact drivers of affordable housing.

In Chapter 3 an impact assessment of the UK built environment and review of

commonly used toolkits is presented. This assessment provides to a deeper insight into the factors and criteria in consideration for better quality of the built environment, as well as configuration of the toolkits.

Chapter 4 is the research method chapter. It provides a detailed sequence of activities involved in conducting the entire research. This chapter provides a discussion of the literature survey, research framework; sampling and pre-case studies; questionnaire development and survey; case studies of affordable housing projects; data collection; pre-analysis qualitative data; data integration/analysis, while ending with expert panel empirical feedback.

Chapter 5 gives a vivid account of five relevant UK built environment quality standards and ten affordable housing schemes (case studies) conducted in this research. Two of the schemes have each been assessed and won awards pertaining to each quality standard respectively.

Chapter 6 is the analysis chapter. The primary data collected from the case studies and the secondary data from questionnaire survey were individually analyzed in sequential manner, starting with the questionnaire data and followed by case study data. A follow-up general analysis for integrated data leading to the development of 'quality index score' as KPI is also presented.

Chapter 7 presents a framework for the conceptual development of affordable housing toolkit using data from literature, questionnaire survey and case study. It shows four (4) principal impact factors; twenty nine (29) parameters and their

constituent variables.

Chapter 8 highlights the process involved in the development of affordable housing quality benchmark model using integrated data from two main sources the case studies and developers'-questionnaire (as indicated in chapter 5). Also presented in this chapter is a detailed account of reliability, variability and validity tests conducted as part of the resultant affordable housing toolkit as well as the affordable housing quality benchmark model.

Chapter 9 contains the conclusion and recommendations, for practitioners and future research. This chapter essentially integrates the outcome arising from the entire research shows how the research aim objectives, hypothesis and questions have been addressed.

1.7 LIMITATION OF RESEARCH SCOPE

The scope of data extract; research analysis; and tests were carried out within the UK built environment, though the benchmark concept is universal and has been maintained as such. Affordable housing quality has been significantly investigated in this study as an overriding issue in comparison to volume of affordable housing delivery. Though, affordable housing dwells within the domain of housing research, it maintains unique characteristics and has been treated as such. Therefore, strict care was observed while investigating the unique criteria and parameters that characterizes affordable housing and also in the development of a proposed toolkit and benchmark.

1.8 CONTRIBUTION TO KNOWLEDGE

Due to the present global economic downturn, emphasis has shifted more to the quality and availability of affordable housing schemes as a panacea to the growing spate of homelessness caused by foreclosures and job losses. A benchmark model will mitigate the temptation of developing poor affordable housing quality that may arise thereof and hence strategically discourage this from the onset. While providing insight into benchmarking development for affordable housing in the built environment, this research consolidates on existing knowledge of benchmark development towards comprehensive articulation of relevant dimensions of quality for UK affordable housing. It specifically provides evidence that different affordable housing schemes have different quality hierarchy which affect their performances. It has also demonstrated the need for the consideration of various quality dimensions at all stages of affordable housing development. An empirical model has been developed and linked with various quality outcomes of different affordable housing schemes. This implies that a developer can easily measure the quality level of each scheme based on an established benchmark, enabling them to identify areas of quality deficiency and address these specifically.

This research has also made the following contributions to knowledge:

- A collaborative system for monitoring the quality of affordable housing in the UK built environment has been established.

- The mapping out of Key Performance Indicators (K.P.I.) of relevant built environment toolkits into a collaborative tool has been done thereby leading to a greater understanding of design specific composition of each and increased efficiency in a more comprehensive package.
- 'PEST analysis technique' built environment quality variables were mapped out against principal impact factors which provided a framework for 'Affordable Housing Toolkit'.
- Relevant UK quality standards were mapped against their parameters.
- The impact weights of the quality values of sampled UK award winning affordable housing projects (case studies) were established, thereby measuring the hitherto intangible qualities (variables) with tangible quantities (measuring scale).
- A 7 steps procedure for implementing affordable housing quality benchmark (AHQB) model for UK, using affordable Housing Quality Toolkit (AHQ) Toolkit is proposed; involving comparative analysis technique and multi-criteria decision making analysis method.

1.9 CHAPTER SUMMARY

This chapter explains affordable housing in the UK context and as adopted in this research. The undersupply of housing and need for affordable accommodation were established as basis of this research. The meeting point between benchmarking and affordable housing was also discussed with a view to identifying the inadequacies of existing benchmarks. The aim and objectives of the

research were established as well as the scope and method of study. Outline of the thesis chapters and limitations and the scope of the study were also discussed.

CHAPTER 2

2.0 AFFORDABLE HOUSING AND BENCHMARK MODELS

2.1 INTRODUCTION

This chapter covers a number of affordable housing definitions and different housing types applicable for affordable housing in the United Kingdom. It also highlights the concept of benchmarking and different benchmark models for housing.

Benchmarking has been defined by many people from varying perspectives. Constructing Excellence, (2006) defined benchmarking as a process that relatively measures and compares performances across the industry, using lessons learnt; hence giving valuable feedback, which enable people to improve their business practices. Freytag and Hollensen (2001) defined it as a way of measuring a firm's own strategies and performance against ''best-in class'' firms both inside and outside a given industry. KPI (2001); and Koskela, (1992) further defined it as a process of comparing and measuring an organizations performance against other organizations in key business activities, and then using lessons learned from the best ones to introduce breakthrough improvements. Some of the keywords associated with benchmarking that are consistent in all the definitions are measuring, comparing, performance, feedback, and improvement.

Freytag and Hollensen (2001) identified four main types of benchmarking in their research: Internal; Industry (or Functional), Competitive and Process (or generic). Internal benchmarking has to do with benchmarking within same organisation; and Industry benchmarking, as occurring within the same industry but among different organisations. Competitive benchmarking is one done externally among competitive organisations for products and services, while process benchmarking is where similar procedures are benchmarked against dissimilar organisations (Freytag and Hollensen, 2001). Therefore, it was on the basis of the foregoing that it became relevant to redefine benchmarking with respect to functional performance of affordable housing.

Apparently, so little has been achieved in improving affordable housing quality through benchmark system in the United Kingdom built environment. This is largely due to the perception of affordable housing as social housing, hence limiting the quality level so as to reduce cost. The influence of this perception is so overbearing in the UK that 'the common man on the street' simply refers to affordable housing as houses for those on benefit. In addition, benchmarking this category of housing type to achieve good quality and still reduce cost is generally an uphill task. More so, clients and developers often aim to achieve the minimal planning standard rather than adding such value that satisfies benchmark quality criteria.

2.2 AFFORDABLE HOUSING

2.2.1 Definitions

In the United Kingdom (UK), affordable housing is defined by the Local authorities depending on circumstances of local income levels, house prices or rents for different household types (The UK Parliament, 2002). In addition to this, the Planning Policy Statement 3 (PPS3) states that, ‘‘UDP policies for affordable housing should define what the authority considers to be affordable in the UDP area in terms of the relationship between local income levels and house prices or rents for different types and sizes of households’’ (CLG, 2006).

The Royal Institute of British Architects (RIBA), perceived the need for a coherent National Planning Strategy for the affordable housing sub sector (RIBA, 2003). Coherency of this strategy can be achieved by a nationally unified definition of ''AFFORDABLE HOUSING'' and, consequently, a single benchmark. A typical example is the SERPLAN definition of affordable housing which is, ‘housing accessible to people whose incomes are insufficient to enable them afford adequate housing locally on the open market’ (Kiddle, 2002). There is a definition of affordable housing that is socially oriented. In this definition the minimum standards for housing which a third party defines as affordable is emphasized. Also, an evaluation of whether a reasonable standard of living can also be achieved at market rents. The standard is set in terms of that income below which housing is regarded as affordable (Kiddle, 2002).

The delivery of affordable housing stock may continually decline with increasing demand. Meanwhile, development of affordable housing tends to be hindered, due to the requirements of the (Section106 Agreement) planning system (Monk 2005). Section 106 Agreement is a legal agreement between the Planning Authority and the applicant/developer and any others that may have an interest in a land (Walsall Council, 2010). Most developers prefer taking up projects that are non-affordable housing not requiring the fulfillment of S 106 Agreement because they see the provisions of this agreement as being very stringent. Therefore, the economic theory of demand and supply could no longer thrive within this unfavorable macro-economic scenario. Presently in the UK, a great proportion of affordable housing delivery is being secured through the (Section 106) planning system thereby providing only three (3) options of mechanisms for developers to explore in delivering affordable housing. These mechanisms are: 1) Payment of a commuted sum; 2) Off-site affordable housing contribution; and 3) On-site affordable housing contribution (Stroud D.C., 2003). However, only two of these mechanisms have a direct impact on the quality of affordable housing. This impact needs further investigation. Thus a further study was carried out here through the development of a theoretical benchmark framework and subsequent toolkit that will elaborate on the above factors and incorporate them as part of its operations.

A well designed housing that is culturally appropriate, structurally durable, spatially functional, and befittingly located within good neighbourhood is everybody' desire, but a few can afford it. Investigating long–term housing under-supply in England, Stewart (2002) emphasized on housing crisis when he reported that total new building in England fell to 162,000 in 2001. Stressing on this, he

revealed that this volume is the lowest since 54 years and by extension since 1924, excluding the war years and its immediate after effects of (1940-47). Some of the direct impacts of housing under-supply include spiral cost and quality reduction. Their negative consequences become clearer as the dynamics of 'Theory of Supply and Demand' comes to bear on them. Under this context, the potential to own a house or rent one becomes at variance with the income levels in the society. The very rich are potentially capable of coping with the impacts than the barely rich that in turn are barely more capable of coping than the poor.

If these impacts are not properly and strategically addressed, they gradually build up from the (bottom) poor, while pervading through all strata of the society to the (top) affluent.

> *"it is imperative that we take a strategic view of the organization of the housing needs in UK if we are to be successful in delivering housing which meets the needs of people in the future. The UK faces some difficult challenges and it is only through collaboration across the industry and with customers, both public and private sector, that we can understand what we need to do to meet these challenges. It is for this reason that we are encouraging individuals, organizations from across the entire housing sector, to get involved in this work" (Constructing Excellence, 2006, pp 2-4)*

The need for the increased delivery of decent and standard affordable homes within sustainable and inclusive communities or environments in England cannot

be questioned. Stewart (2002) first predicted the housing crisis in England when he observed that, ‘‘current house building trends will produce1.5 million fewer dwellings than are likely to be needed over the next 20 years if every household is to have a home and there is to be a sensible margin for vacancies.’’ Table 2.2 below is a clear indication of a mounting building crisis as the annual housing output is marginal and incomparable with the expected figure from experts. Nevertheless, a housing quality benchmark has been identified in this study as one of the areas of UK built environment that requires urgent attention. This is because it has potential attributes for monitoring and improving both quality performance and improvement of affordable housing delivery.

The definition of affordable housing in the UK is a matter for great controversy. This is due to contending and diverse shades of opinions arising from varying needs for affordable housing as recommended by PPG3 (Ealing Council, 1998). These shades of opinions have led to great ambiguity in the way the term ‘affordable housing’ is defined or used. The (PPG3) suggests that local planning authority defines affordable housing relative to its local income levels, house prices or rent for different types of households. The definitions derived through this means are bound to vary and conflict with each other. Each local authority has their definition in their ‘adopted Unitary Development Plan’. The definitions are much more relative to the affordability of existing market housing stocks and local needs.

> *‘Affordable housing costs less to build than comparable market-rate housing. The logical statement was once true. But because*

> *affordable housing was cheaper, it wasn't as good, and because it wasn't as good, the inhabitants, who had no other housing choice, were seen as unworthy. This circle needs to be broken, by making affordable housing that are indistinguishable from market-rate housing' (Davis, 2007, pp. 5).*

Nevertheless, there is need to set a UK national quality standard for affordable housing based on a clearly set definition and nationally set criteria for housing quality despite varying local needs. RIBA (1995) in Carmona (2001) while advocating for more objectivity and certainty in the process for articulating policy statements, suggested that, ''through less guidance on design rather than more, through guidance established at the national rather than local level, and through use of only clearly measurable – quantitative rather than qualitative – criteria as a basis for control''. The criteria identified are mainly associated with various PPGs among which are: Character of place; Access; Space; Uses; Energy efficiency; Parking; Space between buildings; Sustainable development; Style; Materials; Mixed use; Site; Crime Prevention; Internal space standards; Residential amenities; Economic viability; Encourage innovation and Environmental quality (Carmona, 2001). Nevertheless, he failed to establish clear links between these criteria and all or any of the principal factors commonly used in the built environment assessment or analysis commonly known as 'PEST' (Political; Economical; Socio-cultural and Technological) factors. He also did not identify how any method may be applicable to affordable housing.

The ‘Ealing council’ in their ‘adopted Unitary Development Plan’, defined affordable housing as, ‘‘housing accessible to people whose incomes are insufficient to enable them to afford adequate housing locally on the housing market. It includes social-rented or shared ownership housing provided by housing associations or local authorities and low cost homes for sale at discount’’(Ealing Council, 2002, pp 1-21). However, Wilson and Anseau (2006) agreed that, there is no statutory or agreed definition of what constitutes affordable housing.

Affordable housing schemes may include housing for rent, low cost home ownership, one of the various forms of shared equity schemes or a combination of different tenures’. It includes social-rented housing and other forms of sub-market housing which are also known as (intermediate housing). Hence, defining affordable housing simply from the perspective of social housing or wages alone is erroneous and a misnomer. Therefore, this may presuppose that social housing and affordable housing are interchangeably the same. Nevertheless, the definition of affordable housing has remained a variable in England as it means different things to different people or groups, depending on the configuration of their needs. RIBA (2002) highlighted that many local authorities’ housing departments take a myopic view to macro-issue of affordability as they think of their own (social) sector alone. Surveys have indicated that affordability needs run far wider than just that. Basically, needs are major influencing factors for the definition of affordable housing. Conversely, in some areas where there is imbalance of social housing, affordable housing would be appropriate.

While responding to a Parliamentary Question in Britain in June, 2005 concerning what constitutes the definition of 'affordable housing', Baroness Andrews said that:

> *"The Government defines affordable housing as including social-rented housing and other forms of sub-market housing at social rents (i.e. subject to the rent restructuring regime) and accessed via local authority or Registered Social Landlord (RSL) housing registers. Other forms of sub-market housing include forms of low-cost home ownership such as shared ownership and homebuy and housing available at intermediate rents (above social rent but below market rent). Affordable housing can generally be accessed only by existing social housing tenants or people on waiting lists, or other groups specifically identified, such as key workers. It is typically in receipt of public subsidy, but can also be provided by other means; for example, through "Section 106 planning agreement" (Wilson and Anseau, 2006).*

Allison (2002) and Goodman (1999) defined affordable housing as '**housing which rents or mortgages are not greater than 30 percent of the area median household income**'. This version of definition has been most often cited in the research and used in addressing most housing programs by experts and the United Nations, globally. Its validity lies in frequent usage in housing programs globally.

2.2.2 Adopted Definition

For purpose of clarity in this study, the definition of affordable housing as defined by Wilson and Anseau, (2006) 'inter alia' is hereby being adopted. The argument is that no housing scheme could truly be said to be affordable without testing the validity of its affordability in relation to the 'area median household income'. Hence, in that context, affordability becomes the key focus for determining affordable housing. In that sense, it is expected that affordability should not be made to negatively impact on the quality of any affordable housing scheme. It should rather be considered as a component of a comprehensive strategy for reduction of cost, relative to market housing cost and rental value irrespective of sizes, material applications, maintenance cost and durability for any scheme (Katz et al., 2003).

Although affordable housing parameters are in-exhaustive because of variations in constituent criteria with which they were configured, Katz et al (2003) examined three broad approaches to affordable housing development in the United States: 1) rental assistance, 2) homeownership assistance, and 3) regulatory policies. The effectiveness of these parameters was assessed in their capacity to address seven goals of affordable housing which are closely linked to its quality dimension. These goals are as outlined below (Katz et al, 2003).

- Preserve and expand the supply of a good-quality housing units.
- Make existing housing more affordable and more readily available.
- Promote racial and economic diversity in residential neighbourhoods
- Help household build wealth.
- Strengthen families.

- Link housing with essential supportive services.
- Promote balanced metropolitan growth.

The '**rental assistance programmes'** encompasses both the subsidized housing production and the demand-side assistance (e.g. vouchers) which is fundamentally essential in any housing strategy. For increased effectiveness with rental assistance programmes, exclusive clustering of affordable housing within low income-neighbourhoods should be avoided rather strategies for improving the incomes of the low-income households should be put in place. However, it should be noted that rental assistance programs require substantially great subsidies if it is actually intended to reach the mostly needy households (Katz et. al. 2003).

The **'homeownership programme'** is made more effective through improved access to mortgage credit facility. By so doing, more low-income and middle-income households could have increased access to homeownership. However, caution should be applied in this strategy to avoid the consequence of making poor housing decisions. Katz et. al. (2003) suggested that the most successful initiatives for promoting homeownership is best handled by federal rather than local governments. This initiative comes in form of pressure from government to lenders and secondary market institutions to meet financing needs of historically underserved groups.

The **'land use and other regulatory policy'** is a potential tool for affordable housing policy because it does not directly subsidize housing units or households but indirectly impact on the overall production of affordable housing.

2.2.3 Assessing Affordability of a Community

One of the predominant factors used to measure community-wide affordability is the number of homes that a household with a particular percentage of median income can afford. This means that affordable housing need is predicated on the income capacity or level. For instance, monitoring of affordable housing could be done through evaluating households earning 60 percentage of median income. This is the reason why many urban planners and experts have also traced the adverse effects of inadequate affordable housing to the communities' total health and wellbeing.

Figure 2.1: Highland Housing Fair, Inverness (Mead, 2007).

Figure 2.2: Chance Street Tower Hamlets plan, London (Mead, 2007).

2.3 AFFORDABLE HOUSING TYPES

Dwelling units differ in sizes and configuration depending on family size and the purpose of their design. This section highlights a range of dwelling units identified within the UK affordable housing sector.

There are wide ranges of housing types that may be adopted for use for affordable housing development depending on their suitability. The housing types identified within this range in UK are: Terraced house; Semi-detached; Town houses; detached houses; Courtyard houses; Mansion block; Decked Access Block; Tower Blocks; Split-level(Ely, 2004). Table 2.1 indicates the description of these housing types and their application in affordable housing development. Also figures 2.1 shows Highland Housing Fair, Inverness which consists of four units with a density of 56 dwellings per hectare (Mead, 2007)**.** Also, figure 2.2 shows a landscape and floor plan of Chance Street Tower Hamlets at East London with a density of 96 dwelling per hectare (Mead, 2007). This is a typical terrace housing type commonly adopted for affordable schemes.

Table 2.1: Types of Houses used for Affordable Housing Schemes			
SERIAL NO	TYPES OF HOUSING	DESCRIPTION	APPLICABILITY
1	***Terraced houses***	Some significant features of a terrace house model are flexibility, adaptability and affordability. They can be converted into flats and back again. They can be used to accommodate sharers or families. Rooms can also change function or be linked together. One can reverse the living space, and extend upwards and downwards and even sideways or backwards. On the average, 75-150 dwellings of this terrace house can be accommodated within a hectare of land	Usually used for Affordable housing
2	***Semi-detached houses***	This is defined as one of the two houses divided by a party wall	Seldom used as Affordable houses
3	***Town houses***	Townhouses are typically two to three stories in height. Some townhouses include separate rental units, either on the top or bottom floor of a three-story townhouse unit, or in a cottage above a detached garage. They generate a sense of individuality without conflicting with the integrating order of a city street or square.	Fairly used for Affordable housing
4	***Detached houses***	Detached house represents a desire for individuality and isolation. It embraces both the historic country house as well as the twentieth century housing estate.	Hardly used as Affordable houses

5	***Courtyard houses***	Courtyard house demonstrates how indoor space and garden space can be combined in design. In a courtyard house a high degree of privacy is maintained with the living space looking onto an enclosed landscaped courtyard offering a protected garden. A hectare of land can accommodate between 30-75 courtyard houses.	Usually used as Affordable houses
6	***Mansion blocks***	Mansion blocks are often set around a communal square or garden for use by residents and can accommodate apartments and maisonettes. The classic mansion block typically accommodated shops on the ground floor, offices on the first, affluent apartments on middle floors and 'affordable' housing in the attic. The contemporary mansion block has evolved, so that it more typically accommodates expensive penthouses at its top. About 150-300 dwellings of a typical mansion can be accommodated in hectare of land.	Not used as Affordable housing
7	***Decked access blocks***	In 1848 the society for improving the condition of the Labouring classes proposed plans for neat, well built dwellings. One model featured flats entered off walkways either side of a shared staircase, and this became known as deck access.	Fairly used as Affordable houses

2.4 THE BENCHMARKING CONCEPT

The concept of benchmarking in the built environment had been ineffectually practiced for many years, until the release of Sir John Egan's report in 1998. This report titled 'Rethink Construction' challenged the construction industry to measure its performance over a range of activities and to meet a set of ambitious improvement targets (DETR, 2000). This re-invigoration activity within the construction industry gave serious consideration to the strategies for performance measurement and improvement. One of such strategy was Total Quality Management (TQM). The philosophy behind TQM was that of benchmarking or continuous improvement. In other words, the act of increasingly adding value and quality while simultaneously reducing construction cost and schedule.

Constructing excellence (2006) defines Benchmarking as a process that measures and compares a given performance against others across the industry thus using lessons from such benchmark to learn while giving valuable feedback to current endeavours, enabling performance to be improved.

2.4.1 Benchmark Models

The initial uptake of benchmarking in the UK built environment was through traditional method, using measures like profit and loss account as critical success factors (Beatham 2003). Benchmarking was then used as a tactical planning tool and originated from Xerox Business Systems in the late 1970s (Fretag and Hollensen, 2001). Recent application became greatly apparent after Sir John Egan's report on 'Rethink Construction' in 1998. This report raised an incremental need for a step-change in the process of housing delivery in UK through the benchmark process.

Benchmarking, like performance measurement has risen beyond the initial traditional historical orientation and practices in the UK built environment. Most practitioners have been complacent about collaboration of traditional benchmark technique and benchmarking methodology while developing benchmarks. This idea has been found highly essential both in developing benchmarks and also in sustaining synergy or updating benchmarks. Therefore, this study sets out to review relevant models in this chapter. Among the models to be reviewed here are: Total Quality Service Benchmark; European Foundation Quality Model; Affordable Housing Planning Benchmark; and Fiscal Impact Analysis Model.

2.4.1.1 Total Quality Service Benchmark

The Total Quality Service (TQS) model is designed for continuous quality improvement in the service industries. Milakovich (2005) traced the evolution of TQS movement to a mix of various American and Japanese philosophies and strategies linked to the global search for better quality and lower cost. Although more Japanese firms first succeeded in applying the strategy, it was later labelled Total Quality Management (TQM) in the United States. The (TQS) model was derived from the older Total Quality Management (TQM) model and serves to fill-in the gaps for measuring intangible dimensions of quality. The success of ‘‘TQS movement largely depends on how synergically the various dimensions are espoused in an ambience of continuous improvement’’ (Sureshchander et al., 2001).

The TQS model points to improvement in quality management which is generally what benchmark models focus on, but the need to specifically address affordable housing quality was not captured by TQS model.

2.4.1.2 The European Foundation for Quality Management

The European Foundation for Quality Management (EFQM) Excellence Model came about after 14 representatives of European multi-national companies met in 1988 for an initiative to foster quality (Nabitz, Klazinga and Walburg, 2000, p.192). The outcome of this initiative was a multi-dimensional quality management model. It is a non-prescriptive framework (Betham, 2004). The underlying principle is that quality improvement should be done by self-assessment; directed at every activity and level in every organization and made a continuous process (Nabitz, Klazinga and Walburg, 2000, p.192). It is designed to assist companies assess their positions on ''the path to excellence'', understanding the gaps in their practices and stimulating solutions. This tool helps define and assess the continuous improvement of an organisation, and is based on eight fundamental concepts of excellence which are:

- Result Orientation
- People development and involvement
- Customer Focus
- Continuous Learning, Innovation and Improvement
- Leadership and Constance of Purpose
- Partnership Development
- Management by Process and Facts
- Public Responsibility

Although this model has been generally used for quality assessment by various companies, there has not been any evidence of it being customized and applied to Affordable housing quality development.

2.4.1.3 Affordable Housing Planning Benchmark (US)

In 2006, the US Department of Housing and Urban Development developed Affordable Housing Planning Policies Benchmark Program (HUD, 2006). This Benchmark Program was used for monitoring and planning affordable housing. It has successfully been applied in 'The King county development programme' in US.

There are 9 Key Performance Indicators (KPIs) identified under this program which are:

- Supply and Demand for Affordable Rental Housing
- Percentage of Income Paid for Housing
- Homelessness
- Home Purchase Affordability Gap
- Home Ownership Rate
- Apartment Vacancy Rate
- Trend of Housing Costs In Relation to Income
- Public Dollar Spent for Low Income Housing
- Existing Housing Units Affordable to Low Income Household

Although these 9 KPI are relevant for increased delivery and planning of Affordable Housing, they fail in adding value to the overall quality.

2.4.1.4 Fiscal Impact Analysis Model (FIAM)

Fiscal Impact Analysis Model (FIAM) was an impact assessment model originally developed for the Florida Department of Community Affairs. It is a socio-economic tool used to measure the financial implication of a development or of alternative land use scenarios. It is used to assist in validating the financial feasibility of a comprehensive plan by projecting the net cash flow to the public sector resulting from the residential and non-residential development outlined in the plan. The local governments could benefit through the analysis because it offers them the opportunity to determine their ability to fund the capital improvements that will support the growth of their communities, and compare the fiscal implications of various land use options. This tool is a product of Governor Jeb Bush's growth management initiative. It has been used in Hollywood, Orlando, Panama City Beach, and Sarasota, Orange, Sumtar and Palm Beach counties, (all in USA) and was very efficient. Its major limitation lies in its restrictive usage to general residential developments than specifically affordable housing. In the concept of the toolkit (model), Affordable Housing was conceived as part of a community's infrastructure: for instance, sewer, water, and park.

2.5 DEVELOPMENT OF QUALITY BENCHMARK IN HOUSING

Evidence points to previous attempts made by researchers to measure housing quality. In 1967, there was a pilot study conducted in San Juan, Puerto Rico to test a design for multidisciplinary research on housing in developing countries. This study provided an opportunity to assess an approach to the measurement of housing quality (Morris, et al, 1972). One significant aspect of this research was to develop a means for measuring housing quality which might be adopted for urban planning. There was a remarkable departure in the technique adopted in developing an index of housing quality from the previous technique. This departure was recorded in two fundamental aspects, viz:

- The methods used to analyze the data and
- The method of rating the housing.

These procedures however, evolved from traditional scaling techniques without methodological innovations (Morris *et. al.,* 1972). Researchers in especially housing/built environment sector as well as other sectors have recently made huge advancements in measuring various dimensions of housing. However, none of these seems to have narrowed its research towards addressing the quality of Affordable housing using benchmark system. Zari (1994) suggested that benchmarking should be conducted within the framework of Total Quality Management (TQM). Credence to this suggestion can be found in the (EFQM) model for TQM. The model which have thereafter been renamed 'the model for business excellence' sets the scene for organizations to identify their key drivers for continuous improvement and to concentrate on exploring them (Sommerville and Robertson, 2000).

2.6 CHAPTER SUMMARY

Although there has been huge advancement in benchmark techniques/models in the built environment as shown by literature, gaps still exist with the UK affordable housing quality benchmark. These gaps have been recognized as limitation of collaborative benchmark system for measuring quality of affordable housing. Whereas the problem of good quality affordable housing is a consequence of non-collaborative nature of existing standards, models, techniques, solution to poor supply of quality affordable housing does not merely lie with designing the right toolkits. Rather, it extends to coherency of purpose in a single collaborative benchmark system, embracing all dimensions of quality. These dimensions include design; policy framework; delivery process; cost reduction; technological innovation; and partnership of the supply chain and entire stakeholders.

This study sets out to suggest solutions to this by developing a comprehensive and effective benchmark model for monitoring delivery of good quality affordable housing in UK. Studies conducted herein identified fundamental limitations in the existing toolkits and strategies that failed to integrate all parameters for measuring affordable housing quality. It has also failed to draw lessons through impact assessment for the existing situation in terms of affordable homes quality. Hence, application of a collaborative system through benchmark models on a viral

base of expertise is required to transform quality of affordable homes in UK to greater height.

CHAPTER 3

3.0 IMPACT ASSESSMENT AND TOOLKITS

3.1 INTRODUCTION

In this chapter, the need for clearer understanding of the variables responsible for quality improvement of affordable housing in the built environment gave rise to holistic assessment of the built environment.

Therefore, the chapter presents an assessment of the built environment and toolkits being used within the industry. The scope of the assessment is limited to variables relevant to development of quality affordable housing. Also assessed in the chapter were relevant toolkits in use. The principles of 'PEST analysis' was adoption for the purpose of assessing the design, planning, construction techniques and space standard of the built environment. In addition, relevant toolkits in use within the built environment were also assessed.

3.2 AFFORDABLE HOUSING IMPACT ASSESSMENT IN THE UK

While defining Impact assessment, Roche (1999) stressed on the variations identified in forms of Impact assessments. The focus of the objectives of impact assessment is determined by the original policy or intervention. Wider assessment may be focused on revealing overall changes caused by the policy or intervention- positive and negative, intended or unintended. Hence, Roche (1999) defines impact as *'the systematic analysis of the lasting or significant changes- positive or negative, intended or not- in people's lives brought about by a given action or series*

of actions'. He went further to emphasize that in order to conduct an effective impact assessment that one need to be initially clear about what he considers an impact. Impact in the context of this research is considered to be any positive influence that contributes to the improvement of quality of affordable housing. Hence, impact analysis is the evaluation of such influences on affordable housing which are responsible for their quality. These influences are categorized under factors and criteria. In this research, four main impact factors were identified because of their significant roles in the 'critical successes' of affordable housing quality in UK. The impact factors are: sociological, economical, technological and environmental impacts. Also identified were the parameters and criteria under them, which are all relevant for the development of a quality benchmark model. There is need to adopt assessment method with underlying ability to capture unexpected negative impacts arising from poor affordable housing development on the poor in this study (Herbert and Shepherd, 2002; Montgomery, 1996 and Hulme, 1997). Hence, case study; participatory learning/action and rapid appraisal are high with participant observation very high on recommended techniques for use, but surveys are exceptionally low (Table 3.1).

Table 3.1: Strengths and weaknesses of key impact assessment methods (Herbert and Shepherd, 2002; Montgomery, 1996 and Hulme, 1997)

Method Criteria	Surveys	Rapid Appraisal	Participant Observation	Case Studies	Participatory Learning and Action
Coverage (scale of applicability)	High	Medium	Low	Low	Medium
Representativeness	High	Medium	Low	Low	Medium
Ease of data standardisation, aggregation and synthesis	High	Medium	Medium to Low	Low	Medium to Low
Ability to isolate and measure non-intervention causes of change	High	Low	Low	Low	Low
Ability to cope with the problem of attribution	High	Medium	Medium	Medium	Medium
Ability to capture qualitative information about poverty reduction	Low	High	High	High	High
Ability to capture causal processes of poverty and vulnerability	Low	High	High	Medium	High
Ability to capture diversity of perceptions about poverty	Low	High	High	Medium	High
Ability to elicit views of women, minorities and other disadvantaged groups about poverty	Low	Medium??	High	High - if targeted	Medium??
Ability to capture unexpected negative impacts on 'the poor'	Low	High	Very High	High	High
Ability to identify and articulate felt needs	Low	High	High	Medium to Low	High
Degree of participation of 'the poor' encouraged by the method	Low	High	Medium	Medium	Very High
Potential to contribute to building capacity of stakeholders with respect to poverty analysis	Low	High	Low	Medium to Low	Very High
Probability of enhancing downwards accountability to poor groups and communities	Low	High	Medium	Medium	High
Ability to capture the multidimensionality of poverty	Low	Medium	High	Medium	Very High
Ability to capture poverty impact at different levels e.g. individual, household, community	Low	Medium	High	Low	High
Human resource requirements	Specialist supervision, large numbers of less qualified field workers	High skilled practitioners who are able to analyse and write up results	Mid-skilled practitioners. Long time commitment. Need good supervision	Mid-skilled practitioners. Need good supervision	High skilled practitioners
Cost range	Very high to Medium	High to Medium	Medium to Low	Medium to Low	High to Medium
Timescale	Very high to Medium	Medium to Low	High	High to Medium	Medium to Low[4]

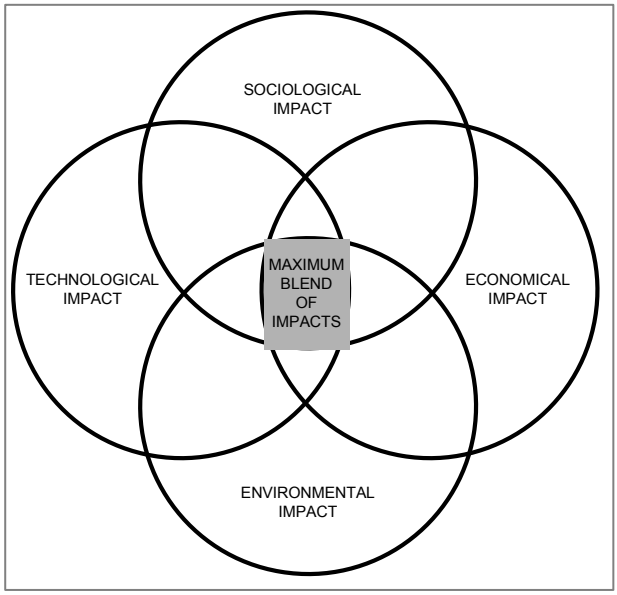

Figure 3.1 Assessment of blended impacts for affordable housing quality

A blend of two or more impacts is possible when the constituent components of two or more principal impact factors blend together at various quantities to result into an outcome. However, maximum blend could be achieved when components of the four principal impacts blend at right proportions in the positive direction to achieve maximum quality output or outcome. The presence of these components or criteria of these impact factors result in efficiency, while the process to introduce them in the system could result in consistency. When these criteria are introduced and their presence is made to be consistent in the affordable housing schemes, then the impacts become positive and affect peoples live positively (Willot, 1985).

Impact assessment technique in the built environment is a complicated exercise, partly due to the complex nature of the built environment developmental process and also due to involvement of a multi-disciplinary team in its developmental

processes. The built environment developmental process requires the activities of numerous professionals to function effectively. The professionals include the Land Surveyors; Architects; Quantity Surveyors; Structural Engineers; Estate Surveyors; and sometimes, the non-professionals like the main contractors and sub-contractors. As a result, each component of the built environment is assessed based on the quality of skills of every professional or non-professional, which arises from the impact of their activities on them.

Nevertheless, there are 3 major stages of infrastructural development in the built environment consisting of the design, construction and facility management stages. These stages are respectively represented by Wilmot (1985) in figure 3.2 as resources, activities/processes and outcomes impacts on people's lives.

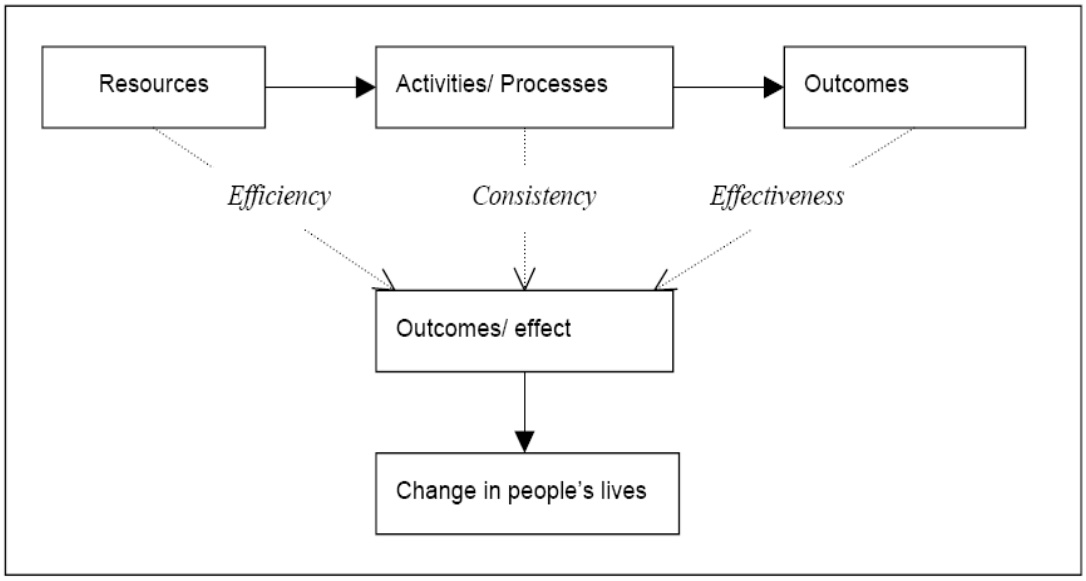

Figure 3.2: Efficiency, Effectiveness & Consistency of Impacts (Wilmot, 1985)

In outlining the checklist of affordable housing quality, Watcher (2006) suggested 20 steps towards achieving good quality affordable housing. These steps are in a checklist as follows:

- To start project book.
- To review advisor resources.
- To understand design timeline.
- To obtain professional design assistance.
- To establish design goals for occupants.
- To establish design goals for community.
- To test the site.
- To begin cost analyses.
- To assemble project design team.
- To develop 3 site plans.
- To use design checklist.
- To use O&M
- To prioritize design components.
- To emphasis design in funding application.
- To prioritize construction system.
- To prioritize finishes and hardware.
- To monitor bids
- To monitor construction.
- To create O&M manual.
- To complete project book

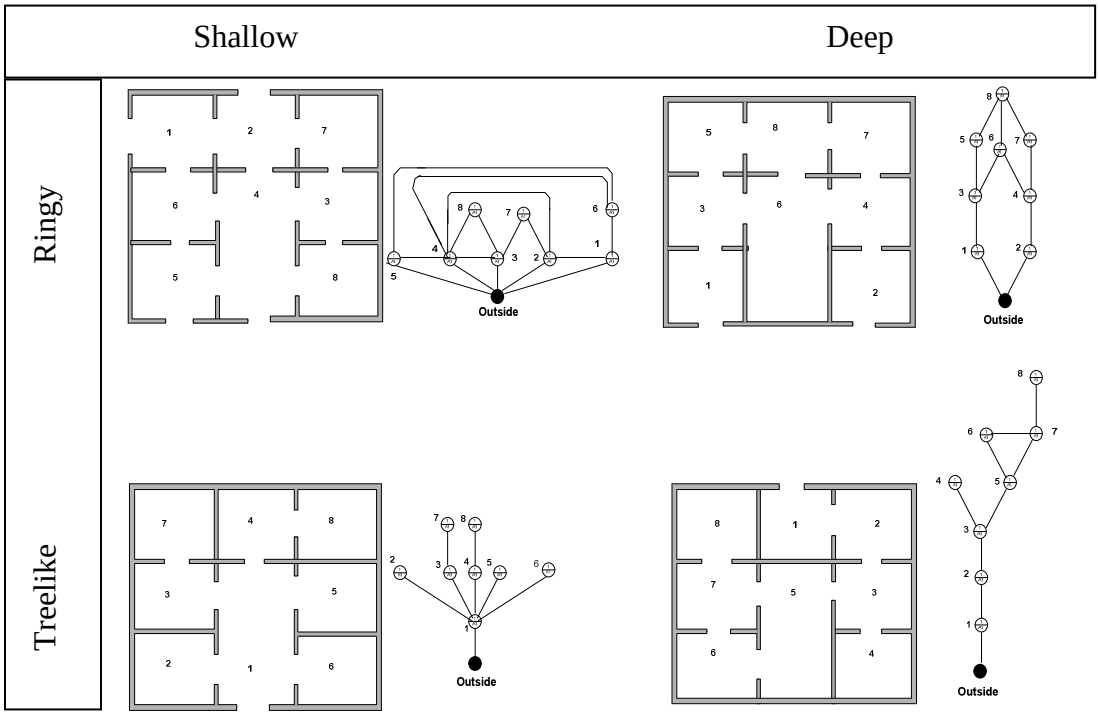

Figure 3.3 Space relationships in Building Design (Penn, 2008 in Hanson, 1999)

Nevertheless, a greater detail is sort in the assessment of the components or criteria which are embedded in the principal factors identified. For instance, Penn (2008) suggested that the geometry and network topology of spatial patterns formed by the built environment has a direct impact on patterns of movement, and so co-presence and interactions between people. It therefore has direct social and economic impact and these should be open to investigation through careful observation and analysis. Therefore, 'the programme of research developed methods for representing and quantifying the geometry and topological properties of space patterns in order to allow differently planned buildings and urban areas to be compared on a quantitative basis. This allowed 'design' at the level which it affects patterns of space' (Penn, 2008). What characterizes network of spaces is the degree to which spaces link together to form either treelike, rings or circuits in

the circulation system (Check figure 3.3). Therefore, this shows how space and the layout of every home have a significant impact on the lifestyle of the inhabitants. In good design, utility of spaces ideally function as buffer zones to the north, with living spaces located to the south of the property.

Various built environment toolkits were identified and examined as part of this study. Some of them are paper based while others are computer based. The need for these toolkits to be investigated was satisfied in this chapter. This significance of this exercise was to ensure adoption of some of their relevant features in developing affordable housing quality toolkit.

In this chapter, assessment of these relevant toolkits resulted in the first stage of the conceptual model. The underlying reason for this chapter was to also critically analyze the toolkits in order to obtain a thorough understanding of their intricacies enabling their effective applicability in developing a collaborative affordable housing quality toolkit and model.

3.3 HOUSING AFFORDABILITY

The population of London is growing faster than that of any other major European city. This is mainly because it is the foremost European mega city and therefore has greatest population attraction from all over the globe. Table 3.2 shows the relative housing stock to household number. This greatly impact on housing affordability. However, housing affordability is a major problem in UK especially for many Londoners: those with moderate incomes are being increasingly priced

out of homeownership, while many more low-income households are struggling to find suitable homes to rent. Kiddle (2002) defined housing affordability based on two categories. These categories include those that are market-based (supply side) and those that are social based (demand side). Key affordability measure is defined as ''the house price to earnings ratio''.

Table 3.2: Building A Crisis: Housing Under-Supply In Great Britain (HBF, 2002)

	Totals				Change 1981-2000		Stock Surplus/ deficit 2000	
	Housing stock		Households		Stock	Households		
	1981	2000	1981	2000				
	(000)	(000)	(000)	(000)	(000)	(000)	(000)	(%)
North East	1020	1127	978	1094	107	116	33	3.1
North West	2660	2956	2551	2874	296	323	82	2.8
Yorkshire & the Humber	1901	2144	1827	2121	243	294	23	1.0
East Midlands	1484	1776	1410	1749	292	339	27	1.5
West Midlands	1941	2206	1860	2178	265	318	28	1.3
East	1859	2285	1764	2284	426	520	1	0.0
Greater London	2682	3054	2635	3186	372	551	-132	-4.2
South East	2750	3333	2644	3382	583	738	-49	-1.4
South West	1728	2128	1638	2103	400	465	25	1.1
England	18025	21008	17307	20972	2983	3664	36	0.2
Wales	1099	1267	1017	1200	168	183	67	5.6
Scotland	1970	2325	1850	2205	355	355	120	5.4
GREAT BRITAIN	21094	24600	20174	24376	3506	4202	224	0.9

The market based definitions relate to the numbers and proportion of households able to obtain rented or owner occupied housing on the open market, on their own terms, or those of a lender or a third party assessment of what is desirable or accessible. Two major ways of measuring housing affordability were identified by Kiddle (2002) as the rent/income ratio means. That is by assessing the proportion of income spent on housing and; the residual income measure and by looking at how much that is left after housing and other essentials are paid for. These measurements are represented mathematically as:

$$\frac{R}{Ira} = \frac{R}{Ni + (Hb \times 100)}$$ (Where *Ira* =Income ratio affordability; *Ni* =Net income;

R =Rent and *Hb* = Housing Benefit).

Rent/Income ratio affordability= Rent/(net income+HBX100) and Residual Income affordability= Net income + relevant family benefits + HB- rent – IS applicable amount…….(Where HB = Housing Benefit and IS = Income Support).

The shortage of affordable housing is most acutely reflected in the number of homeless households seeking shelter in temporary accommodations in London-just under 60,000, two-thirds of England's homeless household population (Wilson and Anseau, 2006). Now, the credit squeeze is depressing the U.K. housing market for the first time in 15 years-and there is uncertainty about how quickly it will rebound. Above this uncertainty is the extent to which new developments will satisfy increasing demand for more affordable homes without compromising the demand for quality.

RIBA (2002) confirmed that, many surveys have shown that affordability needs run far wider than parameters used in assessing social housing. There were instances in central London where even those on quite high wages cannot afford housing. This indicates that 'poverty trap' exists for those who do not qualify for social housing but who cannot afford to rent or buy affordable housing on open market. Figure 3.4 below shows housing affordability rate in England. This is a match of the household income with rent or housing cost. The key shows that affordability rate is lowest below 3.00 (at blue regions) and increases towards 6.00 with highest (at red regions).

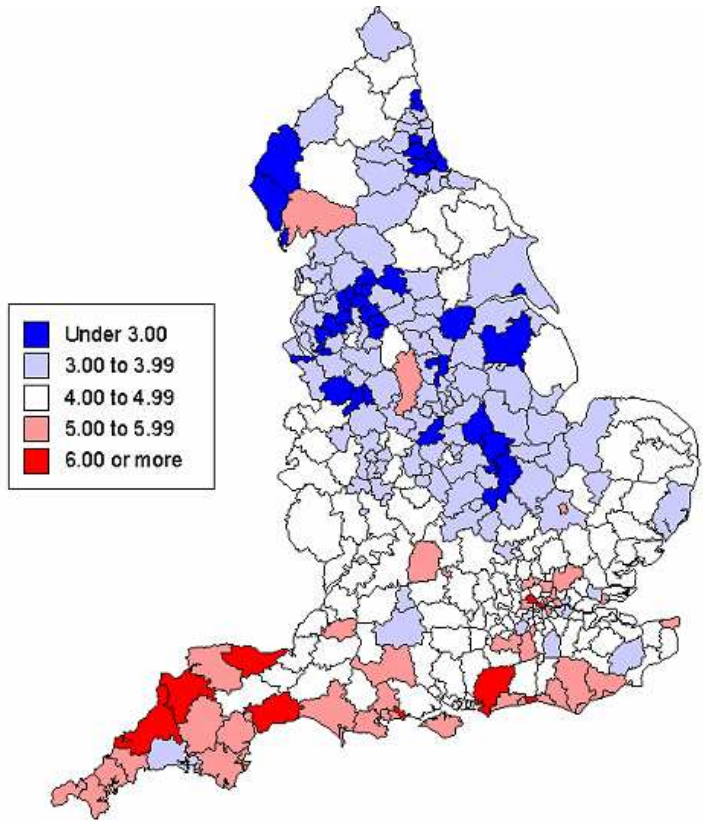

Figure 3.4: Affordability Map of England, (DCLG, 2007).

3.4 KEY DRIVERS FOR AFFORDABLE HOUSING QUALITY

If affordable housing quality will continue on upward trajectory, then it is necessary that new techniques are developed for monitoring and evaluating its performance based on well informed benchmarking technique. The benchmarking technique will have to be based on key quality drivers that impinge on affordable housing. These drivers are derived from modified Political-Economical-Sociological-Technological (PEST) Analysis strategy. This strategy is often applied in research investigation for 'critical' success factors or external impacts on firm (Glaister and Falshaw, pp. 6, 1999). The key drivers applied in this study were achieved by replacing Political (P) with Environmental (Ev) which is much more relevant to the study.

3.4.1 Technology

Researchers and experts are challenged by the increasing need to improve the overall value of new built affordable housing and also better ways of reducing cost while simultaneously increasing efficiency. Technological impacts refer to the aggregate of impacts arising from design, construction, and planning techniques of affordable housing. It also include the application of techniques involved in the use of materials, design, sustainability, energy, planning and zoning in production of good quality affordable housing. This study highlights aggregate of impacts arising from technology of affordable housing production. Davis (1997, pp.4) suggested that building standardization and replication is an easy way to make affordable housing efficient and cost effective. However, it is simply not enough to meet with the minimum set standard in the production of affordable housing or by attaining the cheapest one-off cost for any scheme. It is also significant to ensure that the level of sustainability of the scheme is considered because it is what that keeps the operational cost of the building low at an all times and ensures that the building is made reasonably durable.

Walsh (2002), suggested that 'with adequate emphasis placed on 'adaptability' throughout the design stage of a building, and quality of construction on site, it must be a requirement – to realize the target of a sustainable 'built environment' – that the minimum duration of that building's life cycle will be in the order of:

- For structure 100-200yrs;
- For the building fabric 50-100yrs;
- For services 20-30yrs;
- For furniture & fittings 10-20yrs.

Figure 3.5: Bright Build (WAN, 2009)

Innovative designs can be used to reduce one-off cost and also running cost of affordable housing. One of such innovative concepts is 'Universal World house'. It is a durable structure made entirely from resin-soaked paper. It was developed by a team from the Bauhaus University in Weimar, Germany in collaboration with outdoor advertising specialists The Wall AG, who patented the material. The structures are sturdy, lightweight and more importantly cheap. Costing no more than $5000 for each 42.25 sq m structures provide safe, dry indoor space and outdoor social space in the form of a patio fitted with benches and a table. Thin honeycomb structure panels ensure the walls are light and strong. The design could revolutionize slums and shanty towns worldwide (WAN, 2009).

Bright company developed a prefabricated mortgage-able house which can be constructed in just two days. This low-impact modern prefab structure which was aimed at first time; last time buyers and holiday makers would cost just £60,000. It comes complete with mirrored bedroom wardrobes, sliding pocket doors for the bedroom, bathroom and living room. It also has a lacquer and stainless steel kitchen and residents would feel no different once inside than in any other new-build home (WAN, 2009).

Fig 3.6: Universal World House built with Resin Coated paper (WAN, 2009)

Straw–Bale energy efficient construction is an innovative way of building energy efficient affordable housing using straw-bale infill walling. By application of this technique, there is tremendous reduction in the use of brick thereby saving substantial cost. Buildings constructed with straw-bale is suitable for regions where temperature drops to as low as -40ºc. A straw-bale house of 50-80m^2 can cost between £1,800 and £2,300. Some of the long term benefits are 68 percent

more energy efficient and reduction of CO_2 emissions by 0.6-1.2 tonnes per year than similar sized brick houses (Diacon and Guimarães, 2005).

Sandbag shelter or 'superadobe' system of construction is an innovative system of building developed by Cal-Earth Institute, US. Cal-Earth Institute was founded by architect Nader Khalili in 1991 at California. The technique involves filling and compacting sandbags with earth and laying them in circular plan, course by course. The courses are corbelled towards the top to achieve domical shape at the top. To provide resistance against earthquake and prevent the sandbag from shifting, barbed wire is laid between courses. When fully completed, the structure becomes extremely strong and safe to withstand flood, fire, hurricane and earthquake. For durability, stabilizers like cement lime or ash is added. UNDP and UNHCR have recommended this system of construction for housing those displaced as a result of either natural or man-made disaster because of the following characteristics:

- Flexibility in size, surface area and design.
- Affordability.
- Speed with which shelters can be built.
- Minimum on-site skill requirement.
- The temporary shelters have potential to be enlarged and upgraded to become permanent homes.

3.4.2 Sociology

The policy framework for delivery of affordable housing in the UK is subsumed by social housing policy. This trend which predates World War II to the end of

nineteenth century when the Housing Act was introduced in1901. This act allows Housing associations to register and thereby qualify for subsidy.

Reimer (2004); Room (1995b) and Chapman *et al.* (1998) are of the opinion that 'social exclusion and inclusion are about having access to assets and resources critical to well-being'. Reimer (2004) explained that social exclusion can be multidimensional as one can be excluded from different institutions, social groups, specific benefits and or particular events. There are different ways by which people gain access to these assets and resources. Due to the complicated system of accessing these assets and resources, some people are denied access through consequence, coercion, or sacrifice. Reimer (2004) also identified three 'modes of economic integration' which has been initially identified (Polanyi, 1944). These modes are 'market exchange', 'redistribution' and 'reciprocity' modes. In adopting 'market relations' mode, 'redistribution' and 'reciprocity' were modified into 'bureaucratic', 'associative' and 'communal' modes. This new classification confirms the types of human relations that Fiske (1991) has in his 'analysis of the elementary forms of human relations'.

Bureaucratic Relation is defined as the kind of relation that is based on a rationalised division of labour and the structuring of authority through general principles and rules' (Reimer, 2004). The UK section 106 agreement policy for inclusionary housing or mix tenure falls under this category. Whereas 'inclusionary housing' or 'mix tenure' clause of section 106 agreement policy for Affordable Housing delivery was mandatory in England, as a policy tool, it is provided as optional compensatory benefits in the U.S. According to Ray (2001),

inclusionary housing also requires private developer participation. If incentives for voluntary participation are not sufficient, most developers will not change their practice to include affordable units. Even in communities with mandatory inclusionary housing policies, developers may not participate if requirements are extremely stringent; they may choose to develop housing elsewhere instead. According to Ray (2001) the local government must ensure that effective demand exists for the units to be produced, either by identifying families with incomes that would allow them to purchase or rent the new affordable housing units or by providing additional financial assistance to allow lower-income families to afford the units. Therefore, policy has essential ingredient that considerably influence the production of affordable housing.

In the U.S.A. there are three prominent policy tools used in the mechanism for delivery of affordable housing. These policy tools are: sophisticated secondary market mechanisms; inclusionary zoning and land banking. Others are tax and fiscal policies which result in reduction in cost of mortgages and borrowing; relaxation of prohibitions against accessory dwelling units and reduction of the amount of parking that must be built for a new structure (Glaeser and Gyourko, 2003).

The UK government recognizes now that only by delivering on the quality that numbers can be delivered (Simmons, 2007). The launching of planning policy statement 3 (PPS3) in 2006 underpins the delivery of the governments key housing policy objectives. These objectives laid serious emphasis on delivering homes, but of high quality and higher environmental standards to meet the

challenge from climate change. Local Authorities were by this policy objectives advised to turn down poor quality applications.

There are segments of the population living on very low and fixed income because of age or disability which affects their earning capacity. Studies have demonstrated that targeting public money to provide stable housing for these groups is a good investment because social service spending is reduced once such populations are living in housing they can afford.

3.4.3 Economy

Better designs can make a difference in affordable housing and quality design will: increase the economic viability of the developments, improve the quality of life for residents, and enhance the vitality of the community (Watcher, 2006). Affordable housing construction and development also generates wages, income, local taxes and rates through permits, utility connection and impact fees. Some of the jobs affordable Housing development generates also include off-site and on-site construction works, retail and wholesale sales of housing components, transportation to the site, and the professional services required to build homes and deliver them to the end-user. The direct economic impacts identified result in downstream effects as these expenditures are re-spent in the community and as the project's employees spend their salaries. Government programs and affordable housing policies can help ensure vibrant, diverse, and economically sustainable regions. This will essentially improve the macroeconomic scenario of England with rise in the GDP thereby empowering greater number of households in accessing affordable houses.

In 2001, the annual investment in U.K. housing sector represented 2.3 percent of gross domestic product (G.D.P.). This value was the lowest share in the developed world with 17 percent of gross fixed capital formation. Total housing expenditure accounted for around 14 percent of the G.D.P. while newly built private housing contributed to about 1.2 percent of the Gross Domestic Product (G.D.P.). The number of direct employment especially through private house building in Great Britain stood at 180,000. This was substantial part of the workforce in the sector which was 28,900,000 in the entire nation. Records also showed that 1,610,000 people were unemployed in the same period. A total of 130,000 new home sales were also recorded annually, and were valued at £19 billion (Alsop, 2001). This sharp drop in the GDP was reflected in the volume of housing delivery. During this period, a total new housing completion in Great Britain fell to 162,000 recording the lowest in 54 years after World War II.

Farlow (2005) observed that in the UK, real house prices increased in the long-run, by an average of 2.5 % (percent) per year. This is greater than any other EU country, twice that in France and Italy. For instance, in many EU countries before now, seldom has there been any real house price inflation and that has made UK housing a relatively better investment asset compared to housing elsewhere in the EU. Though, it should be added that the reason is largely because of the relatively low proportion of national income invested in housing per year.

In a free market economy the price of housing is determined by 'demand and supply' and as such this is highly significant in the delivery of affordable housing. High price for houses located at certain areas reflects greater pressure of demand

in this area, while low price reflects increased supply. Land availability and accessibility is also ideally used in restricting supply. Whereas the principle of affordability paradox states that, 'in equilibrium environments, both land and properties are priced based on market values.' This is not affordable to people below median income. The usual urban economic view of housing markets suggests that the restriction on housing supply is availability of land (Glaeser and Gyourko 2003). Affordable housing like any other market commodity is affected by simple economic law of demand and supply. Accessibility and availability of land has a significant influence on demand and supply of housing and also on affordability of housing. Buckley and Tsenkova (2001) have investigated other variables responsible for housing performance. In their findings, certain variables were classified under three broad spectra. These spectra are: (Supply-related external; Demand related external and Policy Outcome groups) as shown in (Figure 3.7) while the variables identified under each spectrum are respectively: economic growth; decline inflation; house-build Industry and credit availability for supply related external influences; demographic trend; rate of in-migration; income and labour policies were grouped under demand related external influences; while fiscal, financial and real estate policies were grouped under policy outcome

While using the 1998 based-population projection, Holmans estimated the anticipated housing stock in England from both new build and regeneration output to the average of 225,000-230,000 per annum from 1996 to 2016 (Stewart, 2002). The estimated figure by Holmans represents the anticipated annual volume of demand. Whereas, according to Department of Community and Local

Government (DCLG, 2006) a total of 163,326 dwellings were delivered for the 2005/2006 period, representing supply for year. Though, the table indicates that it is the highest delivery since 1996, yet delivery remains grossly inadequate (Holmans, 2005).

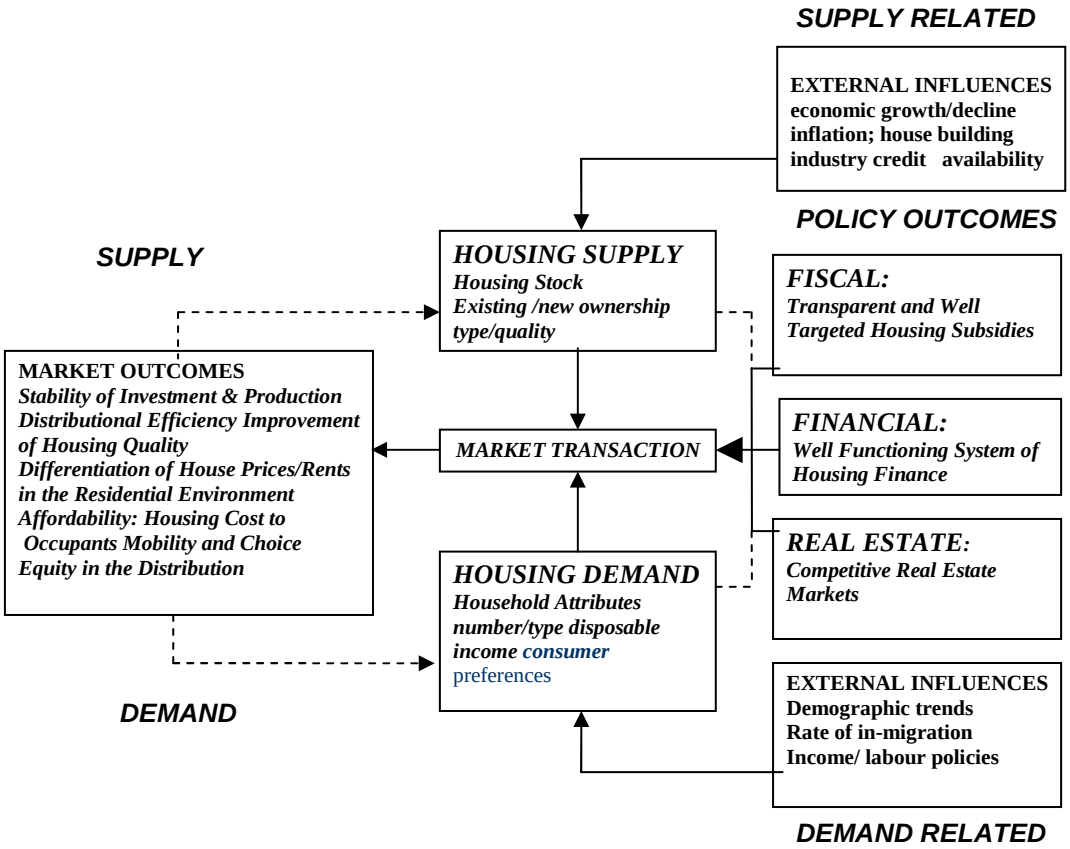

Figure 3.7: Determinants of Housing Performance (Buckley and Tsenkova, 2001)

3.4.4 Environment

The definitions of environmental impact assessment are as numerous as the focus of each assessment. While Munn (1979) in his definition refers to it as the need

‘‘to identify and predict the impact on the environment and on man’s health and wellbeing of legislative proposals, policies, programmes, projects and operational procedures, and to interpret and communicate information about the impacts’’, the Department of Environment (1989) defines it from operational standpoint as, ‘‘a technique and process by which information concerning environmental effects of a project is collected, both by developer and from other sources, and taken into account by the planning authority in forming their judgements on whether the development should go ahead’’. The United Nations Economic Commission for Europe (1991) has an altogether more succinct and pithy definition which states that it is, ‘‘an assessment of the impact of a planned activity on the environment’’ (Glasson, Therivel and Chadwick, 1994). Walsh (2002) defines it as ‘any effect caused by a given activity on the environment, including human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interactions among these factors **;** it also includes effects on cultural heritage or socio-economic conditions resulting from alterations to those factors’. However varying as these definitions are, there are some consistency in most of them that relates to health and well being of inhabitants. A healthy neighbourhood environment can not be completely established until there is good local access to retail, leisure, health and education facilities (Barton, 2003). In other words, it is essential to have proper zoning, absence of polluting substances; and presence of local building materials/resources, waste disposal strategy; good circulation and transport links to achieve good quality affordable housing neighbourhood. If these criteria are true for achieving good quality affordable housing, then how are the increased driver for developing them on brown field sites be justified?

Brown field sites are always referred to as industrial land that has been abandoned and that is also contaminated with low levels of hazardous waste and pollutants (Rolinson, 2009). They are usually recommended for housing development instead of Greenfield sites. These brown field sites may also be located in areas that don't comply with proper zoning for (good) quality affordable housing as required. On the other hand, they differ from Green Belts (Greenfield sites) which are areas of land, usually for agricultural purposes. This type of site is good and usually considered for urban development. It is a highly contentious issue, particularly in the UK, where the development of land is split between Greenfield and brown field sites. It becomes more contentious and political especially due to a limited amount of physical space available, competing with an expanding population that needs housing. 'Many of the new towns of the second half of the twentieth century have been highly successful because of provision of green belts' (DCLG, 2007).

DCLG (2007) suggested that, 'identification of land for housing through the planning system plays a crucial part in the delivery of new housing'. Therefore, more efficient mechanism should be set up to identify lands that enhance the quality of affordable housing. This mechanism should be linked to zoning. There is also need for modern affordable Housing schemes to be more flexible in design, making greater use of different models of financing while simultaneously applying the lessons learnt from 'green architecture'. Also new developments are expected to be designed to meet the highest standards of sustainability, including low zero carbon technologies and good public transport links.

Good design is undoubtedly fundamental to high environmental standard and also significant in inspiring new technologies and approaches. It promotes more sustainable patterns of behaviour. Barton, Grant and Guise (2003) suggested that good housing design should also be essentially located within good proximity to various community support facilities like bus stops; shopping mall; hospital; school (as in Figure 3.8). Such are expectations for good quality affordable housing, but a few can truly achieve these requirements.

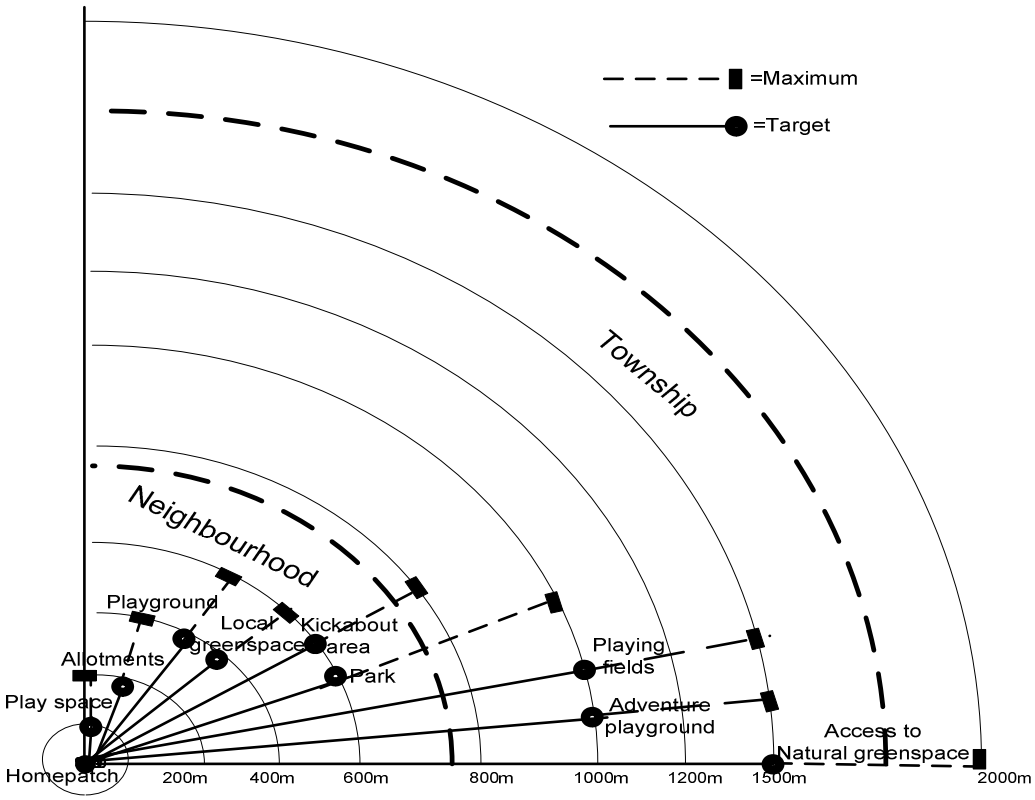

Figure 3.8 Land use-community facilities link (Barton, Grant and Guise, 2003)

This is largely because marginal brown sites or leftover sites are usually available for affordable housing which for various reasons are unattractive; non-profitable for developers and also expensive to develop (Williams, Shiels and Hughes, 2002). However, this inspires the type and number of housing proposed to for each site to

fit into its physical capabilities. There is significant need to correlate the location of each affordable housing site with easy access to amenities and services as may be required by the intended occupants. This means that access to transportation, jobs, and shopping centres will be critical to working-family occupants in every affordable housing neighbourhood. For a project designed for the elderly, access to safe and secure park should be its priority. Hence, the use for each project determines the suitability of its neighbourhood.

A recent release by Building and Social Housing Fund (BSHF) to UK government on spending review with respect to budget cuts proposed by government contains three significant proposals (BSHF, 2010). Whereas these BSHF's proposals greatly encompass economic component considering the present global economic circumstances, other components included are quantity and also environmental components of social housing. Hence, these components are as follows:

1) Support with housing cost

2) Housing Supply

3) Environmental measure

Whereas proposals 1 and 2 have direct bearing on housing benefits; taxation and revenue, proposal 3 deals with issues of measurement of environmental quality and energy efficiency. This measurement can only be effective using the kind of benchmark model and toolkit being proposed in this study to identify social housing that needs retrofit and the kind of retrofit required.

3.5 DESIGN QUALITY INDICATOR (DQI)

Design Quality Indicator (DQI) is a benchmarking toolkit used for assessment of building design quality. This toolkit was designed and published in 1999 by CIC with support from DTI, CABE, Constructing Excellence and the OGC. It is an online questionnaire based tool which assists a building procurement team to define and check the evolution of design quality at key stages in the development process. There are three segments of the tool which are **Functionality**; **Built Quality** and **Impact** (Construction Industry Council, 2004). Figure 3.9 shows these segments of DQI and increasing depth of quality from fundamentals at the periphery to added value and excellence at the deepest.

Impact refers to the building's ability to create a sense of place, and to have a positive effect on the local community and environment. It is split into character and innovation, form and material.

There are two major means of using DQI, namely: Face-to-face and Remote Use. By face-to-face use respondents attend a meeting and are given a presentation by a facilitator on the DQI. Using internet enabled computers respondents complete the questionnaire online. The DQI leader obtains the results of the process instantly for discussion in a later part of the meeting. After the DQI is complete, the facilitator initiates discussion about the results.

By the system of remote usage, the DQI leader briefs respondents-by telephone, or through a 'virtual classroom' on the internet. The DQI facilitator can be used to

take respondents through the process over the telephone. As respondents complete the DQI, the leader receives the results and feeds them back. The team should be able to discuss the results with the facilitator in a telephone conference, a virtual classroom', or at the next team meeting.

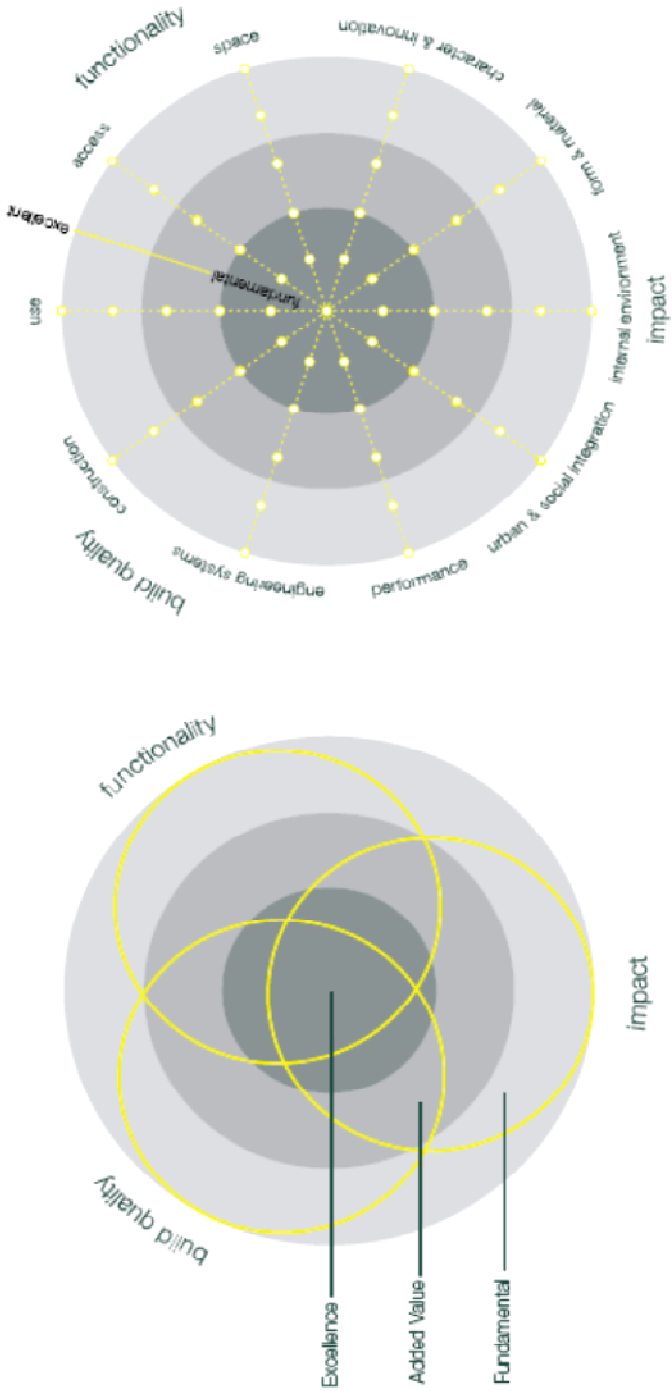

Figure 3.9: Design Quality Indicator (DQI) Toolkit (CIC, 2004)

Some of the projects successfully executed with DQI are:

- The National Assembly for Wales
- The British Library Centre for Conservation
- Newcastle PFI School
- Parliament Hill School
- Doha and Chennai Embassies
- Peckham Pulse Health Living Centre
- Darlaston Swimming Pool

By the end of 2007, over 500 projects had used the Design Quality Indicator among which are 60 percent of all publicly funded or PFI project with a value in excess of £1 million and 20 percent of all projects with a value in excess of £1 million (Construction Industry Council, 2004).

In as much as DQI has great and viable features that make it a very efficient tool for benchmarking especially in the Commission on Architecture and Built Environment (CABE) Awards, it has its restrictive focus on design qualities while granting less attention to economical qualities which is highly significant to affordable housing.

3.6 CONSTRUCTION INDUSTRY RESEARCH AND INFORMATION ASSOCIATION (CIRIA) KPI ASSESSMENT TOOL

The CIRIA KPI Assessment tool was designed to be used by organizations involved in design consultancy as well as contractors with in-house design or a client with a

design function at all project stages which are pre-construction, construction and post-construction. This design assessment tool was designed in 2001 at University of Sussex by Dent R and Story D on behalf of CIRIA. It is a question based tool and is used for post-construction assessment. The questions should be read in the past tense. The tool allows participants to place a different priority order on the various functions through the provision of a weighted matrix, which can be used at the start of the assessment. Where a number of projects are being assessed or where comparisons between projects, departments or sections are undertaken, it is important that someone has the responsibility of ensuring consistency of weighting as well as consistency in approach when completing the assessment.

The CIRIA CD*A*PT Design KPI Assessment Tool has eight main functions that is used by design organizations to improve design activities. These eight main functions are further sub-divided smaller functions. Each of these sub-divisions is explored through a question designed to assess the strength or weaknesses of an organization's process and to position the process on a five-point maturity scale. The matrices adopted reflect the range from minimum to the best practice known at the time of development of the tool.

3.7 DTI Housing Quality Indicator (HQI) Toolkit

This tool was designed by DEGW on behalf of Department of Trade and Local Government and the Regions (former ODPM) and Housing Corporation. The HQI system is a measurement and assessment tool designed to allow housing scheme to be evaluated on the basis of quality rather than simply cost. The HQI assesses

the quality of a housing project using 3 main categories, which are location, design and performance. The nature of its presentation is partly (paper booklet) form and scoring spreadsheet.

3.8 BEST VALUE PERFORMANCE INDICATOR (BVPI) TOOLKIT ANALYSIS

Best Value Performance indicator (BVPI) Toolkit was published on behalf of Office of the Deputy Prime Minister (ODPM) in August 2002 at University of Birmingham. The K.P.I. (Key Performance Indicators) of this toolkit are numerous as they measure the after use performance of buildings. (Please refer to BVPI Column of KPI matrix in Table 3.2). This toolkit has proved to be essential components for measuring the most intricate aspects of housing for the disadvantaged poor and ethnic minorities. The aspects of measurement considered in this toolkit were derived mainly from the concerns of the user's as their needs were the primary focus of the toolkits (Murie and Walker, 2002).

3.9 OFF-SITE PROJECT TOOLKIT

Off-site Project toolkit was developed by CIRIA toolkit. It is used for achieving the benefit of off-site construction. It offers guidelines on the concept and the process towards achieving maximum benefits of off-site production through appropriate application. It also assists project team in understanding the relevance of proactive design decisions and early collaboration among the team members. It can be used to develop strategy for optimising and measuring the benefits in

relation to key project drivers and constraints (Gibbs and Pendle bury, 2005). The benefits of off-site toolkit indicators are as shown below in table 3.3.

Table 3.3 Outlined benefits of Off-site Toolkit Indicators

Performance Indicator	Improved health and Safety	Improved Environment	Reduced Cost	Reduced Time	Reduced Defect	Increased Profitability	Increased Predictability
Benefit from Standard Process	Health and safety Risks reduced	Environmental issues can be covered	Reduced time and effort to learn new systems	Save time by under-standing processes (eg shorter tender periods)	Familiarity improves quality and reduce defects	Profitability of all stake-holders improved	Tried and tested processes are predictable and Enable continual improvement
Benefits from Standard Components	Installation is better understood and safer	Less waste	Economies of scale and scope reduced maintenance	Lead-time reduced dramatically	Better quality easier to install	Profitability of all stake-holders improved	Proven track Record
Benefits from Pre-assembly	Off-site works reduce risk of injury or ill-health	Better environment control	Overall savings indirect costs must be considered	On-site/ off-Site activities run in parallel installation is rapid	Factory environment and pre-delivery inspection and testing improves quality and reduces defect	Profitability of all stake-holders improved	Performance ensured by off-site testing and inspection

Table3.4 UK Built Environment KPI Matrix (Toolkits)

Code No.	Key Performance Indicators	BENCHMARKING TOOLKITS				
		DQI	HQI	BVPI	CDAPT	OFF-SITE PROJECT TOOLKIT
O1	Health and Safety					•
O2/H1/O2	Environmental (Internal and External)	•	•			•
O3/C1	Cost				•	•
O4/C2	Time				•	•
O5	Defects					•
O6	Profitability					•
O7	Productivity					•
O8	Predictability					•
H2	New Build		•			
H3	Refurbished and Planned Work		•			
H4	Repairs		•			
H5	Voids		•			
H6	Respect for People		•			
D1	Use	•				
D2	Access	•				
D3	Construction	•				
D4	Engineering	•				
D5	Space	•				
D6	Performance	•				
D7	Urban and Social Integration	•				
D8	Form and Material	•				
D9	Character and Innovation	•				
C3	Understanding Client Needs				•	
C4	Design Process				•	
C5	Design-Supply Chain Integration				•	
C6	Risk				•	
C7	Reuse of Design Experience				•	
C8	Innovation				•	
C9	Client/User Satisfaction				•	
B1	% of unfit private sector dwellings made fit or demolished			•		
B2	Average SAP rating			•		
B3	% of vacant private sector dwellings occupied in 2000/01 as a result of LA action			•		
B4	Average weekly management costs			•		
B5	Average weekly repair costs			•		
B6	Rent Collection and arrears:% of rent collection			•		
B7	Rent arrears as % of rent roll			•		
B8	Rent written off as % of rent roll			•		
B9	% of homelessness applications decided within 33 working days			•		
B10	Average re-let times in days			•		
B11	% of rent lost through dwellings becoming vacant			•		
B12	LA dwellings receiving renovation work as % of those needing work under £5000			•		
B13	LA dwellings receiving renovation work as % over £5000			•		
B14	% of urgent repairs completed within Government time limits			•		
B15	Average no. of days taken to complete non-urgent responsive repairs			•		
B16	Satisfaction of council house tenants with the overall service			•		

B17	Satisfaction of black and minority ethnic tenants with overall service			•		
B18	Satisfaction of non-black and minority ethnic tenants with overall service			•		
B19	Satisfaction of council house tenants with participation in decision making			•		
B20	Conformity with CRE code of practice for rented housing			•		
B21	Length of stay of families with children in temporary accommodation			•		
B22	Proportion of LA homes which were non-decent at 1 April 2002			•		
B23	Change in proportion of non-decent local authority homes between 1 April 2002 and 1 April 2003			•		
B24	The % of repair jobs for which an appointment made and kept			•		

The table 3.4 above shows an array of Key Performance Indicators (KPI) from UK built environment toolkits. These KPIs differ from each other because they were tailored after specific purposes and therefore focused towards these in their design. Based on the data collected from the toolkits shown in the table, an initial concept of a proposed Affordable Housing Quality Benchmark model was attempted in figure 3.10. The toolkits were represented in the table with each specific sector as shown. The indicators are also shown and evenly distributed in each sector. At the centre of the pentagon is the point of least or zero impact, then with increase towards points of greatest impact at the sides.

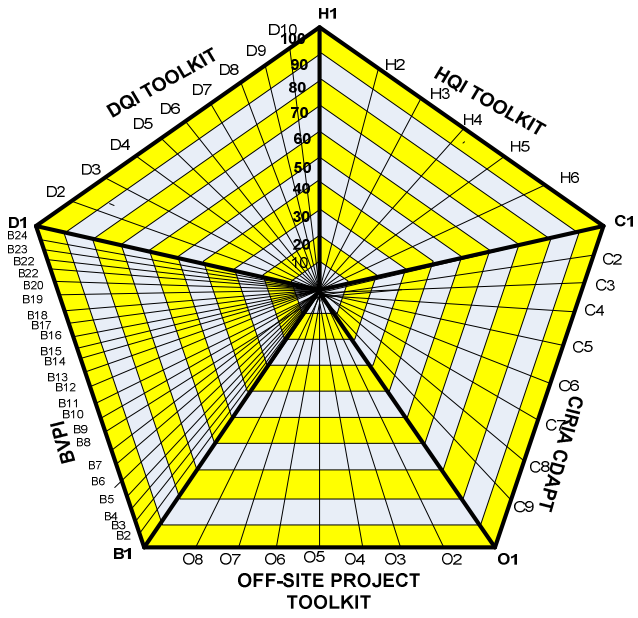

Figure 3.10: Stage I of conceptual AHQB Model

3.10 AFFORDABLE HOUSING DEVELOPMENT CONTROL TOOLKIT

Affordable Housing Development Control Toolkit, 2006/2007 version is a recently developed toolkit. It is used by the Mayor of London boroughs and the Housing Corporation to test the viability of residential schemes and whether any social housing grant is required to contribute to their output. It is efficient for control of Affordable Housing in relation to the Mayoral objective that 50 percent of additional housing provision should be a form of affordable housing. It was developed in June 2006 by Three Dragons consultancy and Nottingham Trent University for the Greater London Authority (GLA) and the Housing Corporation.

It is a CD ROM computer model operating on Excel which assists a financial appraisal of residential development options which have a potential for incorporating an element of affordable housing. The purpose of the toolkit is to assess the development economics of providing affordable housing on individual sites. The toolkit is used to assist negotiations between local authorities, residential developers and housing associations especially while negotiating s106 agreements. The toolkit is policy neutral but allows the user to test the economic implications of different types and amounts of planning obligation, including the volume and mix of affordable housing sought and amount of public subsidy.

The toolkit includes a set of local authority default values for all London boroughs. It also operates on the basis of scheme specific data where available. The present cost of the toolkit is £125+£21.88p VAT. Meanwhile, it is under validation to ascertain its veracity.

3.11 QUALITY FUNCTION DEPLOYMENT (QFD) TOOL

Quality function deployment (QFD) or 'House of Quality' is a tool used for monitoring quality of building projects. Although, this tool is a very versatile tool for improving building quality, however, building quality has very many dimensions, depending on the type, size and function. These specifics have to be thoroughly investigated and made relevant to any tool used in quality measurement. This tends to be limitation of this tool which has not considered the criteria relevant to affordable housing.

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It was originally developed by Japanese auto manufacturing industries. This technique used by this tool has many similarities to value tree and decision matrix and has also been used to achieve considerable improvements in product design. In recent time, this technique has successfully been adapted for use on some construction projects.

The technique has six parts and requires understanding of the principles of matrix analysis with addition of quality and benchmark criteria. The QFD has the advantage of carrying forward through the key stages of design development, the project values and criteria in a way that ensures that everyone is consistently working towards same values. Gray and Hughes (2001) analysed the six parts which are also known as 'rooms' in the house of quality. They also explained that:

- In Room 1, the primary objectives of the project must be stated by the client. These needs to be a brief statement with key contribution that the project intends to achieve.

- In Room 2 (The whats): The objectives of the client are subdivided into ways that the overall objectives can be satisfied in the same way that the value hierarchy is broken down. The requirement is that all of the issues, including those not normally stated such as robust structure, are also stated such that there are no areas missing. Each requirement in the list is then ranked for its importance.

- Room 3(The hows): A list of all the ways of satisfying the whats is recorded in a row across the top of the matrix.

- Room 4(The relationship matrix): All of the hows are assessed against each of the whats on a sliding scale: 0 for no link, 3 for a partial satisfaction, and 9 for a strong satisfaction.

- Room 5(Technical assessment): The scores for the hows are totalled, from which the most satisfactory method of solving the particular requirement can be seen. This can be given an absolute score or a relative score.

- Room 6(Competitor analysis): Quality is known to be a subjective issue. Conducting analysis on building design is more complicated than in a product design consumer product.

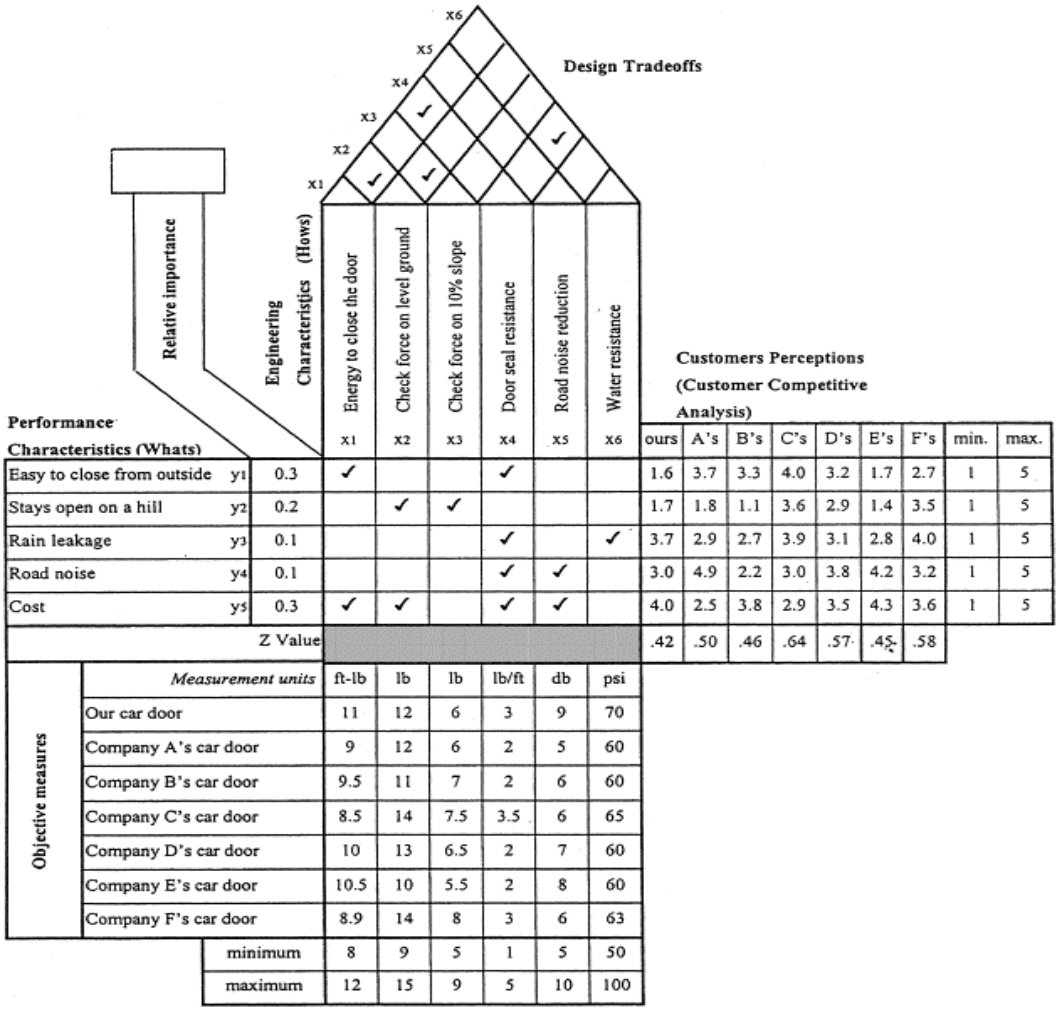

Figure 3.11: House of Quality Chart

3.12 CHAPTER SUMMARY

Every analytical tool has its limitation, (Fishkind and Schriever, 2005). Each toolkit has its design specific focus and therefore limited in some areas. The toolkits discussed in this chapter have been individually used for benchmarking in the built environment. In this research, benchmarking toolkits are classified under two categories. They are: toolkits focusing on few housing development issues and those focusing on more comprehensive community planning development.

The toolkits focusing on few housing development are: Design Quality Indicators (DQI); Housing Quality Indicators (HQI); Best Value Performance Indicators (BVPI); Construction Industry Research and Information Association (CIRIA) assessment toolkit and Off-site Project Toolkits while those focusing on more comprehensive community planning development are: CDP Outcome Measurement Toolkit, Fiscal Impact Assessment Model (FIAM) and Affordable housing Development Control Toolkit. Despite efforts for the use of these toolkits in built environment benchmarking, there is huge gap in their collaborative approach towards using them in benchmarking the quality of affordable housing developments. Hence, that is what this study aspires to fulfil.

CHAPTER 4

4.0 RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter explains the procedure by which this research was conducted. The study adopted the mixed research method approach; with the greater dominance of the qualitative technique for developing a quality benchmark model. When attempting to measure an impact the qualitative techniques are most often useful (Brophy and Woodhouse, 2003). Hence, the application of this technique was significant at the primary stage of this research. Mixed methods research is defined as a 'research design with philosophical assumption as well as method of inquiry' (Cresswell and Plano-Clark, 2007). The outcome of this research builds upon a theoretical framework of impacts on the quality of affordable housing. Primary data were obtained from archival; industrial and academic literature with complimentary site visits. Deduction of solutions through analysis was indicative of the prevalence of varying impact factors influencing the quality of affordable housing. Relevant construction toolkits, Key Performance Indicators (KPIs) and Benchmark models were also examined critically as part of the approach towards customizing a toolkit for the proposed model.

Critical and comparative analyses were conducted on sampled affordable housing projects. The outcomes of the comparative analysis led to the development of Key Performance Indicators (KPIs) and subsequent customization of an affordable housing toolkit. A questionnaire that is responsive to streamlined affordable

housing quality impacts and Key Performance Indicators was developed for use in a national survey. Data obtained in the national survey was integrated with data obtained from the case study of affordable housing quality standards. The outcome of this analysis was interpreted using the positivist/post positivist paradigm of qualitative method; leading to new truths and hypotheses.

The application of a questionnaire survey through a critical observation underpins the significance of this technique as a robust means for collating and analysing data required in developing an affordable housing benchmark. Also this could be used as a means of monitoring improvement. The target groups or respondents for this survey were derived from among Architects, Builders, Planners; Developers; Contractors and Sub-Contractors. Through this means of data gathering, an affordable housing benchmark model was developed and validated, while the quality toolkit was also developed and tested for reliability test. The model validation was done through soliciting feedbacks from a questionnaire; which was dispatched to practitioners in the affordable housing sector.

4.2 RESEARCH STRATEGY

In this study, the nested analysis approach was adopted as a research strategy in view of varying sources and types of data requiring integration. This strategy, developed by Lieberman (2005) is a system of unified ‘‘mixed methods’’ approach to comparative research. ‘Nested analyses’ combines the statistical analysis of a large sample of cases with the in-depth investigation of one or more of the cases contained within the large sample. The Questionnaire data considered under (L-N-

A) presented large sample size comprising of a total of 197 variables (cases) of ten affordable housing schemes. The application of this approach to this research is shown in (figure 4.1). The thick arrows with preliminary LNA (Large Nested Analysis) of data collected through the questionnaire survey resulted in an output that was neither robust nor satisfactory, thus requiring 'model' testing. The SNA was therefore subsequently adopted for a small number of case testing and refinement within the large case selection and assessment. The number which started big with 197 dimensions was finally narrowed down to 4 cases (of Affordable housing schemes); 4 impact factors and 29 criteria. Scaling down the magnitude of the dimensions was necessary to reduce the withering nature of data, hence grouping them under reconcilable and recognizable factors used in the research.

Fig 4.1 shows the two major pathways of the research processes. The right hemisphere commences with hypothesis and ends with 'empirical result'; the left hemisphere commences with data collection and ends with a 'Theory'. The right hemisphere was adopted in this research with milestones like hypothesis; research design; selection of measurement assisting in the deduction of empirical evidence. This was chosen because of its relevant consideration of measuring scale is to this study.

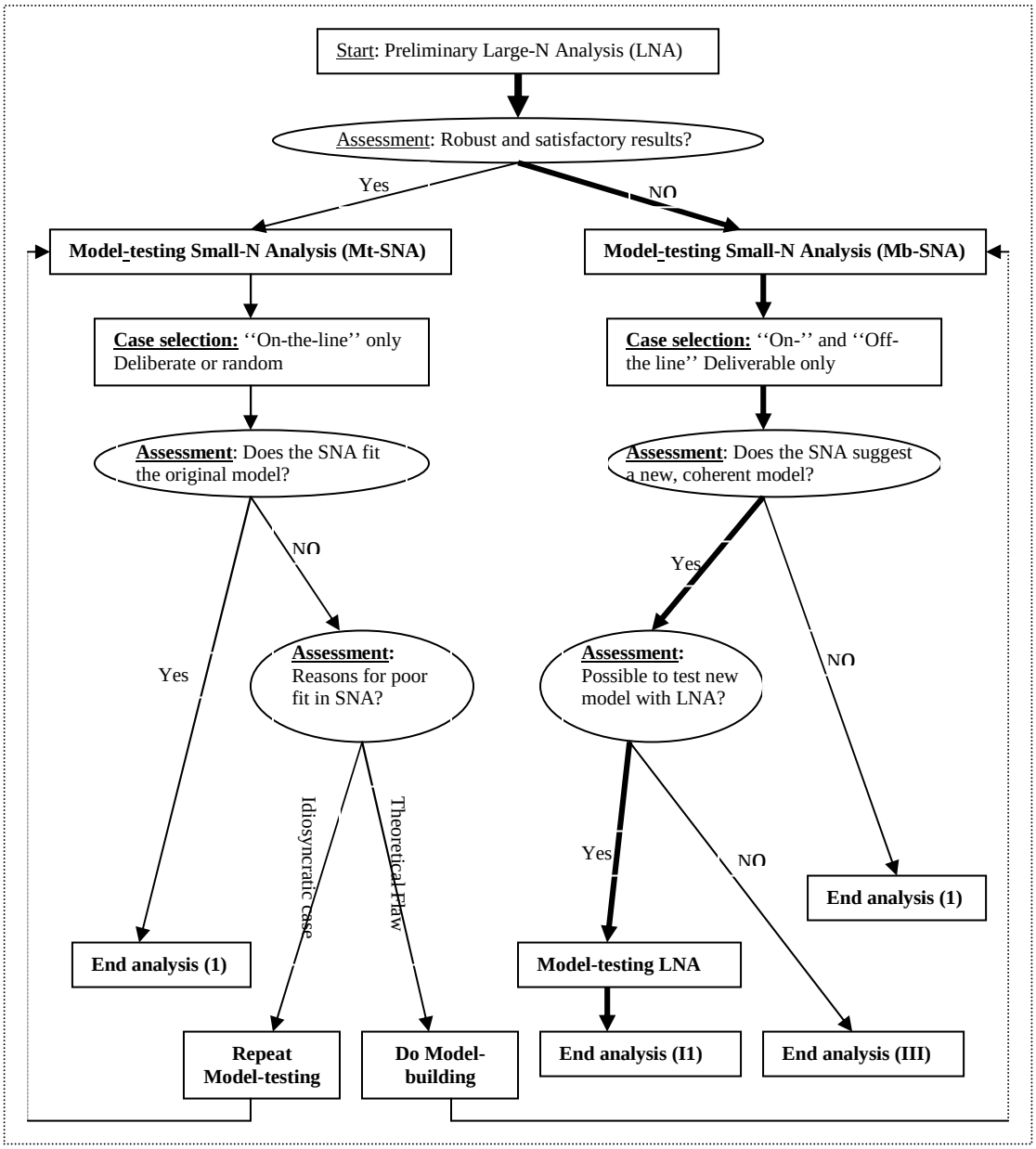

Figure 4.1 Nested Analysis Approach of research strategy (Lieberman, 2005)

The strategy for research analysis shown in fig 4.1 was highlighted by '**Sequential Exploratory Design' (SED) (**Taxonomy Development Model**)** as illustrated in figure 4.2 (Creswell et al., 2003). This technique of analysis is characterized by an initial phase of qualitative data collection and analysis, followed by a phase of quantitative data collection and analysis. Essentially, priority is given to the

qualitative aspects of the study because the quality attributes are easily communicated in themes than in numbers (Creswell *et al*., 2003).

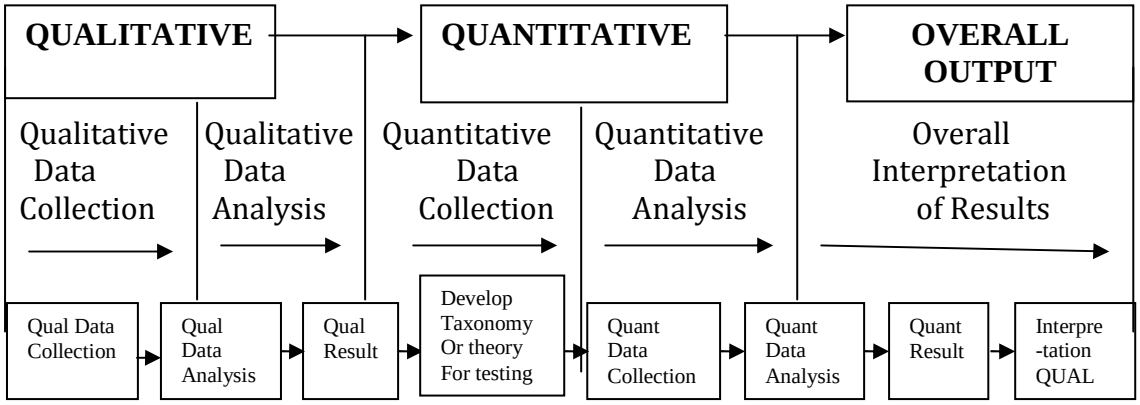

Figure 4.2 Sequential Exploratory Designs (Instrument Development)

4.3 LITERATURE SURVEY/RESEARCH DESIGN AND FRAMEWORK

A research design/framework shows the flow and function of various aspects of the research. This research design is fragmented into three phases with Phase I having two sub-divisions of literature survey and seminal discussions. A survey of all articles related to the area of study was done during the 'literature survey'. This survey gave an overview (general knowledge) of the research topic. In addition to 'literature survey', conference / seminar discussions were held to highlight grey areas of this study. These exercises were essential for substantiating the aim and objectives of the research and to review relevant built environment toolkits. Hence, it facilitated the design and development of the conceptual toolkit.

Phase II of the research design comprised data collection and analyses where Questionnaire and Case studies were used. Under questionnaire, quantitative data were obtained through development, pilot study and general survey, while qualitative data were collated through case study; documentation of archival records, observation and informal interview. Both of these sources of data were aggregated, integrated and analyzed to develop an 'affordable housing quality impact assessment toolkit' and 'the affordable housing quality impact assessment benchmark model'. The validation of the resultant toolkit was tested under this phase.

The last phase which is phase III presents the procedure for implementation of the resultant Affordable Housing Impact Assessment Model (AHIAM) with tests and validations for the fitness of the model while establishing future quality criteria for affordable housing schemes. These were clearly shown in the research framework in Figure 4.3.

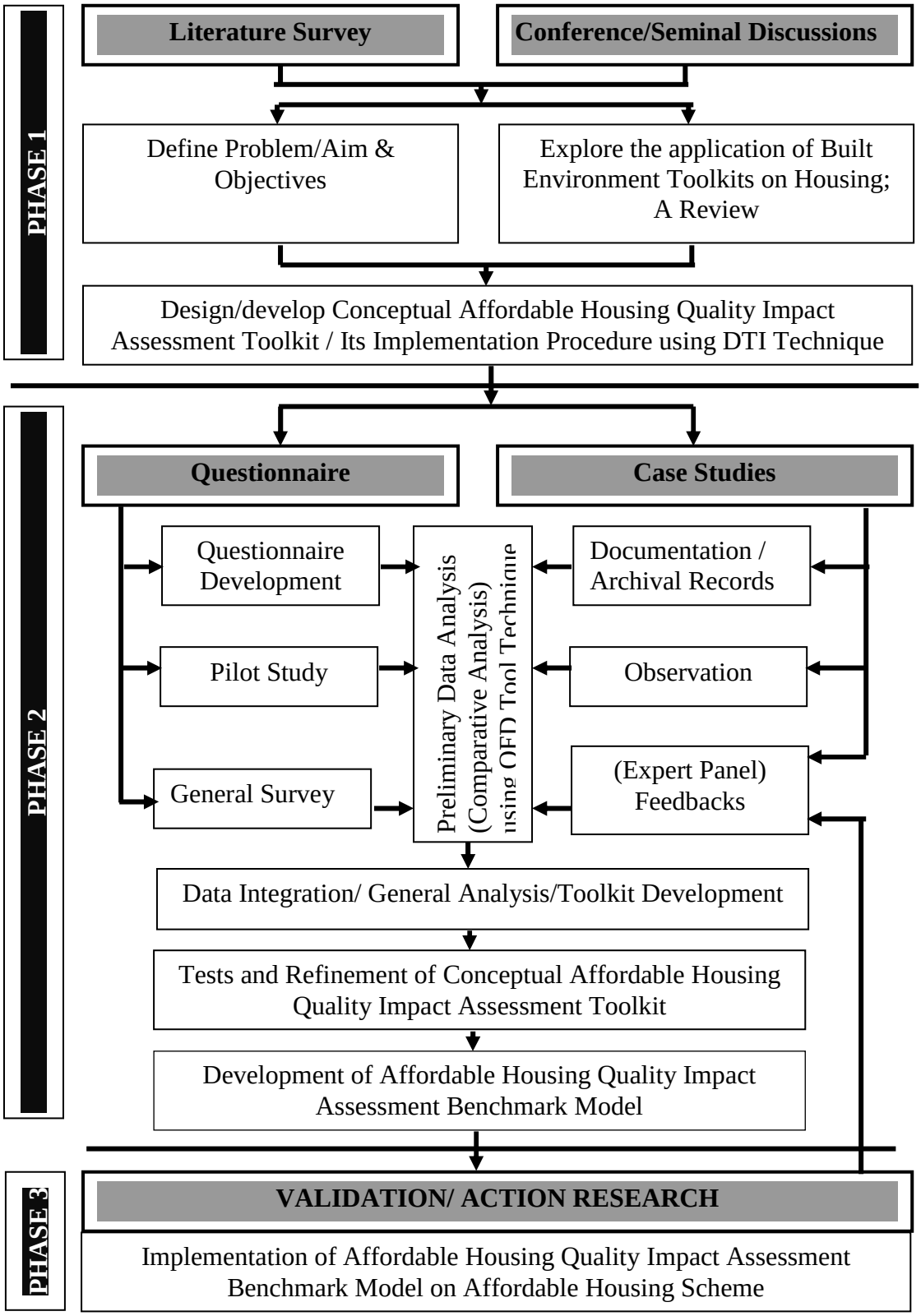

Figure 4.3 Research Framework

4.4 MAPPING, GROUPING AND WEIGHTING OF IMPACTS

For a clear understanding of the significance of all quality standards (QS) identified in this research, an evaluation involving mapping, encoding and weighting was carried out. This was done by grouping the QS with their parameters and assigning identical codes to each level. The weighting was done with scale 1=(Least Impact); 2=(Low Impact); 3=(Average Impact); 4=(High Impact); and 5=(Highest Impact).

Aggregate of the weight of each impact factor is determined for each QS and compared with each other to evaluate the best overall quality attained by all QS. A codebook was developed with this data and the value of data obtained thereafter was considered as the UK 'Quality Index' for affordable housing. Creswell and Plano-Clark (2007) explained that a codebook may be generated during a project and may rely on codes from past literature, as well as codes that emerge during an analysis.

With the use of this technique of qualitative data screening and cleaning a number of things were achieved among which are:

- Searched for the spread of all the criteria within the impact factors of the quality standards.
- Determined the weights of the impact factors as they occur within each case study project.
- Identified and codified the themes in the project samples.

- Grouped themes in the case study and linked them up with measuring criteria through mapping.
- Linked the sample projects to overall data and other attributes.

Comparative analysis of themes generated from project samples helps to eliminate bias and extract significant data needed for benchmark development. The parameters of housing quality standards identified in the UK built environment were categorized with their parameters mapped out against impact factors. This is shown in figure 4.4 and highlights the predominance of some parameter over others. The figure also highlights areas of deficiency (gaps) that needs being addressed in the proposed new affordable housing quality standard (model).

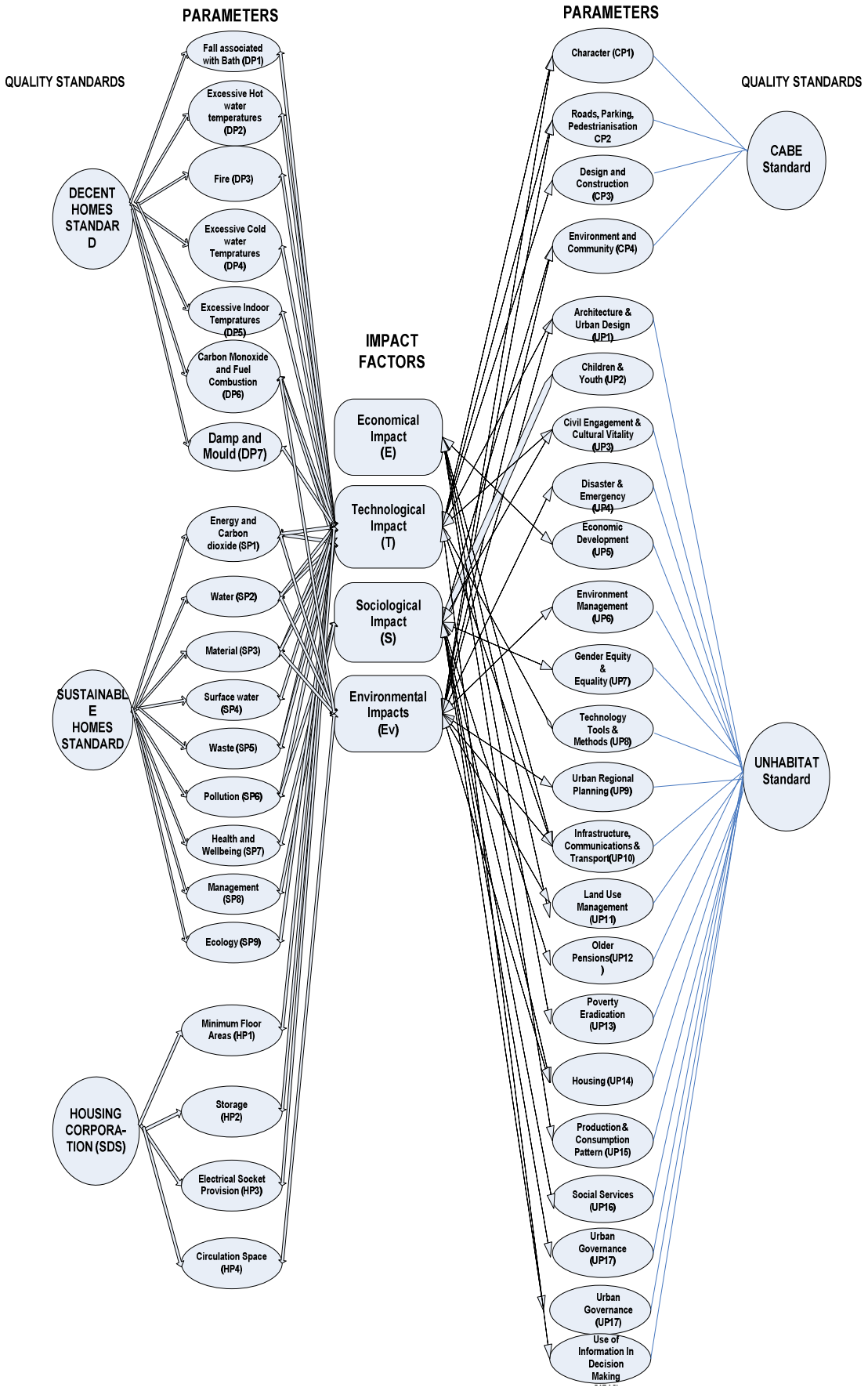

Figure 4.4: Quality Standards Parameters/Impact factors mapping

4.5 SAMPLING/PRE-ASSESSMENT STUDY

To conduct study of the best set of representative UK affordable housing sampling technique was adopted with a pre-assessment study of identified samples. Samples of affordable housing were drawn from 10 schemes selected from a list of 84 UK affordable housing projects (refer to Appendix I). Kemper, et al, (2003) described mixed methods sampling as a simultaneous selection of units of study through both probability (to increase generalizability/transferability) and purposive sampling strategies (to increase inference quality). They also outlined various kinds of sampling under two broad categories of 'probability and purposeful' techniques. Under Probability sampling are Simple, Systematic, Stratified (Proportional and non-proportional) and cluster, while under purposeful are Convenience, Extreme/deviant (confirming/disconfirming cases and typical cases), Homogenous case, (Stratified purposive and random purposive), and (opportunistic and snowball) sampling. This research adopted extreme/deviant case sampling in selecting 29 variables (parameters) from an initial set of 197 variables which were derived from 10 'high qualities' affordable housing schemes identified for study. At this stage of the research, it was significant to ensure a genuine and thorough search for the projects that outperformed others in their respective categories for investigation.

A literature search conducted earlier in this study led to the compilation of a list of affordable housing projects (sites) in UK. In addition to this relevant quality standards were identified. From among 84 schemes identified (as shown in Appendix I) 10 affordable housing projects were sampled and grouped according to the UK housing quality standards with which they were assessed. These quality

standards have been previously used to assess the identified affordable housing schemes. Two of the affordable housing projects that won good quality award for 2 of each quality standards and 1 of the third were selected from all relevant operational UK quality standards. All together 10 schemes were originally pre-assessed from 5 quality standards, subsequently, 4 schemes were further examined from 3 quality standards. The primary focus for the sampling and pre-assessment study was to confirm that the projects identified for in-depth studies have been assessed by credible organizations with credible quality standards.

4.6 QUESTIONNAIRE DEVELOPMENT

Earlier in this study, the quality performance of sampled affordable housing schemes was measured. Structured questionnaire survey was used to collate quality performance (data) from practitioners (respondents); showing the level of compliance to quality criteria while developing the sampled schemes. The questionnaire used in this study and as shown in appendix 1 was structured using the impact assessment framework shown in figure 4.5. The target respondents ere drawn from the same group of professionals used for the samples as indicated in the figure. These respondents were drawn from practitioners who were involved in the development of the sampled affordable housing projects investigated in the case study.

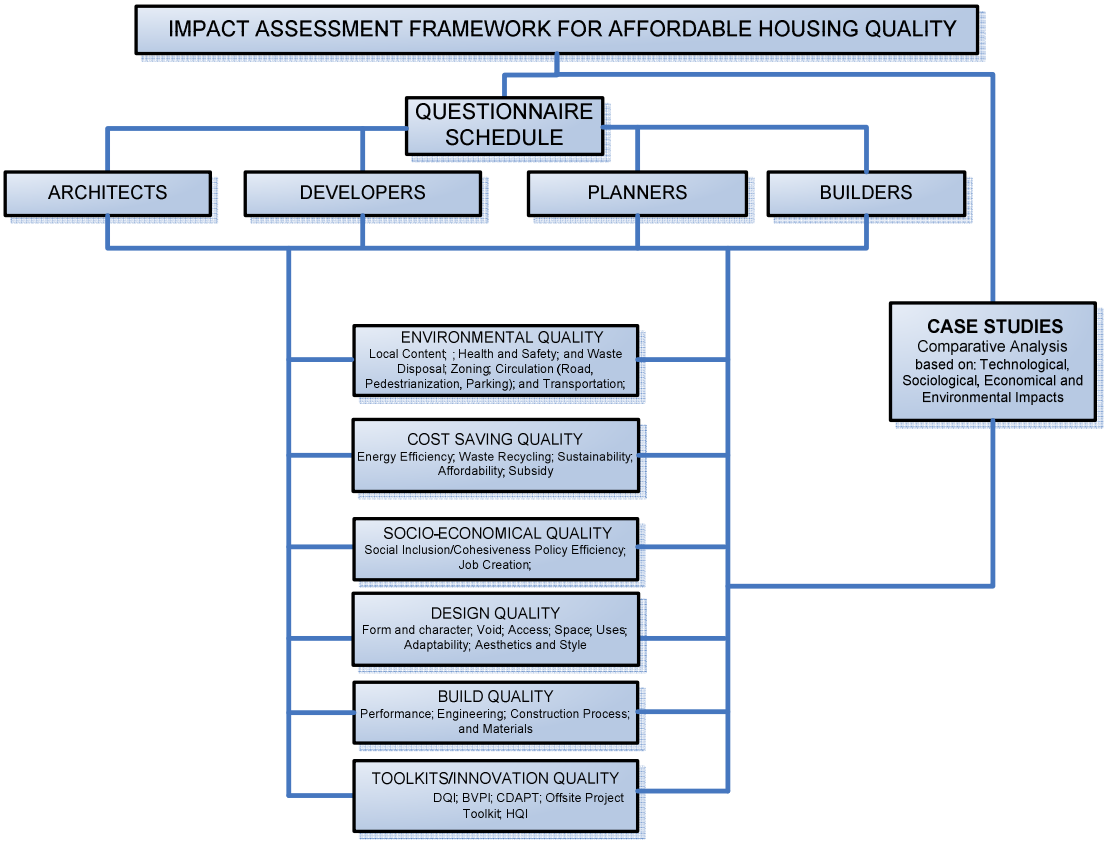

Figure 4.5 Impact Assessment framework for Questionnaire and Case Studies

Beatham (2003), Steele (2000) and Brenner et al, (1985) suggested that the design of a questionnaire should involve a process with several general stages which are: 1) Understanding of the areas to be explored; 2) Understanding of the question wording and sequencing; and 3) Understanding of the physical design and layout. The questionnaire was structured having the 'initial research K.P.Is (Key Performance Indicators)' as part of its framework. This was done as a basis for covering a broader area for data extract through questionnaire survey in this research. The development process is as shown in figure 4.6.

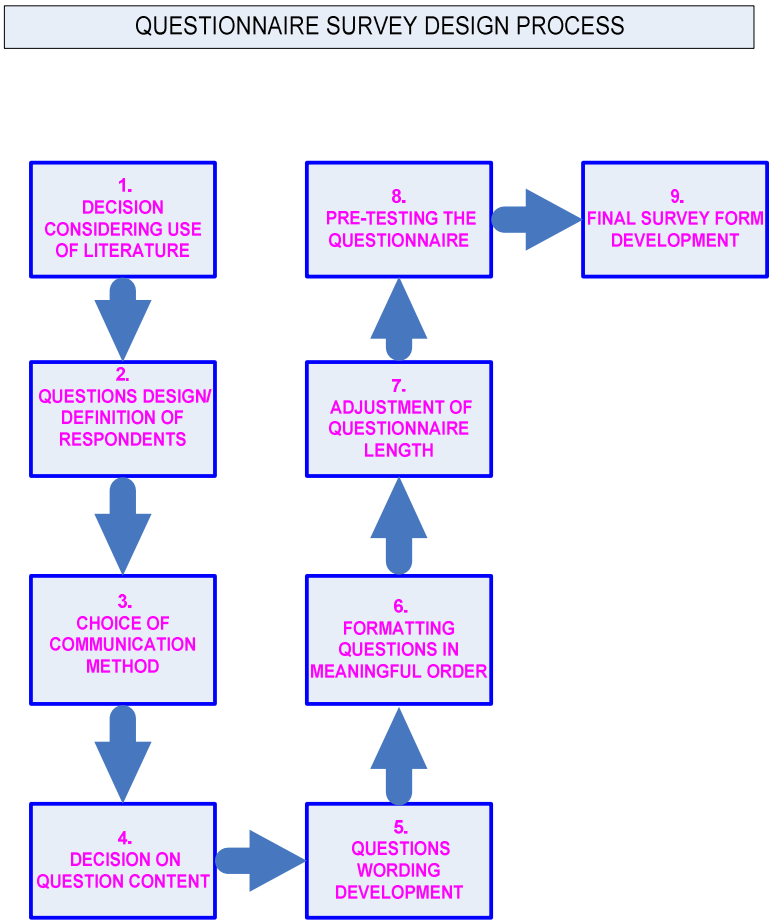

Figure 4.6: Questionnaire Development Process

4.7 CASE STUDIES OF AFFORDABLE HOUSING PROJECTS

Definition of 'case study' is as varying as the authors that define it. While Orum et al (1991) seeks to holistically explain and understand the dynamics, Eisenhardt (1989) and Stoecker (1991) sees it as a single contemporary social phenomenon; and Blismas (2001), opined that it is an empirical study and Yin (1994) saw it as an in-depth, multifaceted inquiry.

This study adopts Yin (1994) perception of case study in indentifying the quality criteria in the sampled affordable housing projects studied. Therefore, the project

case studies investigated were conducted using normative style of comparative analysis. In other words, there was a comparison of each criteria identified in these project to determine the strength and weaknesses of each of these projects. The adoption of this style was relevant in this study because of the importance attached to the best values of the impact factors in this research.

Proverbs and Gameson (2008) identified two broad techniques for conducting case study research, which are: 1) Longitudinal and 2) Cross-sectional. They further explained that longitudinal case study sets out to investigate a subject's changing pattern and development over a period of time, while a cross-sectional case study tends to capture on-the-spot situation of a subject. The cross-sectional technique tends to freeze the timeframe for investigation. This technique was adopted to restrict the timeframe for investigation and accommodate the mixed method analysis approach.

Relevant KPIs of operational quality standards were mapped out against measurable factors impacting on each of the projects on which these were assessed and were investigated with a special note of their prevalent impacting trends. The case study approach may combine a variety of data collection methods and research strategies (Fellows and Liu, 2003). Data used for comparative analysis in this research was collated by this means to reveal the strengths and weaknesses of each quality standard in terms of constituent parameters. The need to fill-in the gap identified in each quality standard gave rise to the need for a comprehensive toolkit that will ensure a collaborative output. Preliminary secondary data collected during this process resulted in the development of UK

affordable housing quality index in this exercise.

4.8 DATA COLLECTION

Data collection in this study involved both primary and secondary data. Primary data was collected from developers of affordable housing using a questionnaire and secondary data was collected through case study conducted on samples of affordable housing schemes. The data collected was based on the success criteria of the investigated schemes. Additionally, site observation was also conducted to clarify the state of the schemes with respect to the documentation concerning them.

4.8.1 Pilot Study

A conference forum was exploited to administer this questionnaire. The conference was held in September 2007. A pilot study for this research was conducted using the questionnaire in (Appendix 4).

The pilot study was directed at practitioners in the UK affordable housing supply chain, who were hugely in attendance at the conference. These practitioners included: Architects, Engineers, Planners, Builders, Contractors, Sub-contractors, Local Authorities, Registered Social Landlords, Housing Associations, Estate Surveyors, Private Landlords, Charitable Organizations, Religious Organizations, Mortgage Institutions, Tenants and Owner Occupiers. The underlying idea for this pilot study was to identify the group of practitioners that have the most impact on affordable housing quality. Feedback from this exercise indicated that the band of

developers is the most. This band mainly comprises of architects, planners, engineers,

4.9 QUESTIONNAIRE STRUCTURE

Design of the questionnaire structure was established bearing in mind, the impact factors being investigated in this research and the components of quality (Design, Construction and built environment). Also considered for most of the questions on the questionnaire are the impact levels achieved for targeted factors. The focus target respondent groups in the questionnaire were: Architects; Engineers; Planners; Builders; Developers; Contractors; and Sub-contractors. They were also considered in structuring the sections of the questionnaire. The research objectives were also considered.

4.10 ADMINISTRATION OF QUESTIONNAIRES FOR GENERAL SURVEY

During the administration of questionnaire for general survey, e-mail addresses and telephone numbers of Architects, builders, planners and developers involved in the development of UK affordable housing schemes (as shown in appendix 1) were collated. A framework indicating collection of parameters classified under 6 quality dimensions represented in the questionnaire was earlier shown in figure 4.5. These quality dimensions were earlier derived from the 4 principal impact factors investigated in this study. This was done to ensure that all questions in the questionnaire significantly cover quality parameters being investigated in this study.

Surveys conducted by e-mails are known to be very economical and fast, and were the major reason for adopting this technique. The questionnaire survey in this research was carried out using e-mail contacts. It commenced with the identification of the relevant e-mail addresses and telephone numbers. Prior to sending the questionnaire by e-mail, telephone calls were put through to respondents to solicit their consent and sensitize them on the relevance of the questionnaire. Compilation of a mailing list was significant aspect of this technique because it makes bulk sending easy. This was followed by attachment of the questionnaire to a covering mail before finally sending them. Subsequent to sending the questionnaires to respondents, reminders were also sent at 2 weeks intervals for 2 month.

The essence of this exercise was to get as much details of the schemes as possible but it failed to achieve this requiring further details and in-depth study of quality criteria embedded in the quality dimensions investigated.

4.10.1 Advantages of Questionnaire Survey

All members of the supply chain assessed or surveyed have email accounts and full Internet access. Email is found to be a better choice than a web page survey for this group of population because it saves time to access e-mail accounts and open up the questionnaire than a web page. Also the mail account is often accessed and in some cases an incoming mail alert indicates the arrival of a new mail whereas a web page hasn't got this feature. On the other hand, email surveys are limited to simple questionnaires, whereas web page surveys can include complex logic.

Among the advantages identified in the use of this technique for dispatching questionnaires to respondents are:

- **Speed**: An email questionnaire can gather several thousand responses within a day or two.
- **Cost**: It took minimum cost to set up and complete.
- **Extra Features**: There was relative ease in attaching pictures and sound files if desired.
- **Ease**: The novelty element of an email survey stimulated the kind of response that ordinary "snail" mail surveys could not.

4.10.2 Disadvantages in Administering Questionnaire by E-mail

Despite the above listed advantages in adopting the technique in this research, there were also some disadvantages identified. Among these disadvantages are:

- **Respondents' List**: Collecting a comprehensive list of respondents' email addresses on line was time taking and sometimes needed to be purchased.
- **Multiple feed-backs**: Some people will respond several times or pass questionnaires along to friends to answer. Many programs have no check to eliminate people responding multiple times to bias the results. The Survey System's Email Module will only accept one reply from each address sent the questionnaire. It eliminates duplicate and pass along questionnaires and checks to ensure that respondents have not ignored instructions (e.g., giving 2 answers to a question requesting only one).
- **Unsolicited mailing:** Many people dislike unsolicited email even more than unsolicited regular mail. You may want to send email questionnaires only to people who expect to get email from you.

- **General Findings:** You cannot use email surveys to generalize findings to the whole populations. People who have email are different from those who do not, even when matched on demographic characteristics, such as age and gender.
- **Thoroughness**: Email surveys cannot automatically skip questions or randomize question or answer choice order or use other automatic techniques that can enhance surveys while the Web page surveys can.

4.10.3 Ethical Issues

Before administering the questionnaire on the respondents, ethical issues were considered in this study. As a requirement for approval by the University research committee, the questionnaire past through series of screening that were conducted by the supervisory team. In addition, confidentiality was maintained in handling data collected from individuals and organisations (respondents) involved in the questionnaire survey. Also restricted is direct mention of names of respondents or organisations directly involved in the schemes assessed in this study. This was also observed for archival materials collected from case study from organisations.

4.11 DOCUMENTATIONS FROM ORGANIZATIONS: ARCHIVAL RECORDS

Before and during carrying out case studies on sampled affordable housing schemes, it was relevant to gather sufficient data about the schemes to be investigated, the developers; the location and the history. This was made possible through exchange of correspondence with the concerned organisations to ensure easy flow of information. Huge quantity of data concerning the schemes under

study was obtained through documents. They came in form of newsletters, books, DVDs, internet web links, and drawings from relevant organisations concerned with development and assessment of the schemes under study. Proverbs and Gameson (2008) agree that this documented evidence will be useful in laying the foundations for the study.

Proverbs and Gameson (2008) defined archival records as information focusing upon the past of the company or organisation or project under study which may be in form of computer files and records located at the head office . Archival records of projects were obtained from organisations involved with the sampled case studies. Also obtained are archival details of measurement leading to emergence of sampled projects as winners of best practices in their respective categories. These archival details were obtained from neutral organisations that have carried out comparison in the past on the sampled projects together with other projects. Also obtained from these organisations are the details of the tools they used in assessing these projects.

The list below indicates the selected case samples earlier assessed by UK quality standards. A sample of 10 schemes was drawn from among 84 UK Affordable housing projects (as shown in appendix 1).

4.12 SITE OBSERVATIONS/INVESTIGATIVE STUDIES

To collaborate with the details obtained from individual quality standards concerning assessed sampled projects, on-the-site investigative observations of the projects were conducted. This was relevant to have first hand information on the physical features of the projects, and also note changes that may have occurred over time. This was established by assessment of real site situation, having secondary data drawn from therein and also from the developers.

Ackroyd and Hughes (1992) identified four techniques of observational roles of participants. In the conduct of any site investigation, an observer may participate in any of the four outlined roles to achieve the purpose of their investigation. These roles are: 1) Complete observer; 2) Complete participant; 3) Participant as an observer or 4) Observer as participant roles and are further discussed below.

The role of a **'complete observer'** requires investigators to insulate themselves from any social contact whatsoever with the subjects. In view of the nature of this study, requiring observation and comparison of the quality criteria of 10 schemes, time limitation was highly essential and also biases were considered at minimal level or completely eliminated with the **'complete observer'** role.

In the **complete participant** role, the observer becomes a full-fledged member of the group under study. This technique is expensive and also time consuming.

Participant as observer is where both researcher and subjects are aware of the fact that theirs is a fieldwork relationship. The observation results are scarcely inhibited by time or cost constraint. This is the rationale behind adopting this technique to compliment documentation/archival records earlier conducted and collected on case study samples. Under this circumstance, the researcher was originally an observer and subsequently a participant.

O**bserver as participant** is where the involvement of the participant with the subjects is deliberate. This can be kept to a minimum for a number of practical reasons e.g. where there is high cost or time in getting involved in the activities on the site. Due to cost and time constraints this options was not utilised.

4.13 SYNTHESIS OF QUALITATIVE DATA FROM CASE STUDIES/ARCHIVAL RECORDS

Before synthesis of case study data/ archival records commenced, a framework was drawn to determine the parameters of quality as well as the criteria to be identified in the case studies. This framework was drawn using KPIs/or parameters of existing UK built environment quality standards. The quality standards were mapped out against their parameters and corresponding impact factors. This whole concept was developed into 'qualitative code book' with the idea of capturing subjective qualitative themes into objective quantitative numerical. The focus was to determine which of the magnitude of the strengths and weaknesses of four principal impact factors identified in the case studies. Project observation was essential to clarify gray areas that could not be

comprehended through documentation. This is so because physical situations are better understood than documented ones.

4.14 PRE-ANALYSIS OF QUANTITATIVE DATA

The computation of pair wise comparison and relative importance index were adopted in identifying the dimensions of quality that were relatively more important. A total of 197 quality dimensions were identified from the questionnaire. These dimensions were derived from main components of housing quality and other considerations represented within the questionnaire. The components are design, planning, construction, durability and cost.

It was possible to draw a hierarchy of importance of these dimensions from the analysis; as well as weighing these dimensions. Priority considered were all criteria that contribute to good quality affordable housing.

The least important variables were marked for elimination following further confirmatory and evidential test from case study samples. Case studies conducted on these samples, stimulated in-depth investigation into identified impacts factors in each project. This strategy was extensively adopted in this research and was made possible by observing the case studies (Affordable housing quality standards)

Table 4.1 Evaluation of Impact Assessment methods, (Herbert and Shepherd, 2001)

Sample Surveys are appropriate when:	**Rapid Appraisal and/or PLA are appropriate when:**	**Participant Observation and/ or Case Studies are appropriate wh**
The intervention affects large numbers Accurate estimates of impact are required Statistical comparisons must be made between groups over time and/ or between locations Delivery/implementation mechanisms are operating well, thereby justifying investment in the assessment of impacts The target population is heterogeneous and it is difficult to isolate the factors unrelated to the intervention	The intervention is participatory principles in (re)-planning, implementation, monitoring and evaluation An understanding of motivations and perceptions is a priority One of the purposes of the study is to assess whether or not felt needs are being addressed by the intervention The impact of community-based organisations or other institution building activities are of importance There is a need to understand the quality of the data collected through surveys There is a need for contextual studies before designing more complex monitoring or impact assessment exercises (e.g. case studies or surveys)	An understanding of perceptions is a priority Other methods are likely to capture the views of women, minorities and other disadvantaged groups One of the purposes of the study is to assess whether or not felt needs are being addressed by the intervention The impact of community-based organisations or other institution building activities are of importance There is a need to understand the quality of the data collected through surveys or rapid appraisals (e.g. causal processes of poverty) There is a need for contextual studies before designing more complex monitoring or impact assessment exercises (e.g. before carrying out rapid appraisalsor before designing a survey)
Sample Surveys are usually not appropriate when:	**Rapid Appraisal and/or PLA are not usually appropriate when:**	**Participant Observation and/or Case Studies are usually not appropriate when:**
An intervention affects a small number of people Policymakers are mainly concerned about the outcomes of the intervention e.g. how many people use the health clinic? Implementation is recent and untested and it is likely that the way in which the intervention is implemented will have little impact in the present time The purpose of the assessment is to study complex activities or processes (e.g. the development and operation of communities) The purpose of the assessment is to document easily observable changes in the physical environment or other tangibles The purpose of the assessment is to understand whether or not the intervention is meeting the felt needs of the beneficiaries	Interventions are relatively un-complex, in which bounded locations are not units of analyses (e.g. health centres serving a wide catchment area) Indicators of impact are uncontroversial and negative impacts are unlikely Standardised and statistically representative generalisations for large and diverse populations are regarded as the sole priority Participation of beneficiaries is not priority	The intervention is small and 'uncomplicated' providing a specific service or limited intervention which is unlikely to affect community dynamic beyond a few specific effects (e.g. diseases specific health facilities or campaigns) Bounded locations are not units of analysis Indicators of impact are clear and easily measurable or assessable (by survey or rapid appraisals) Indicators of impact are uncontroversial and negative impacts are unlikely Information is needed quickly, and standardised, statistical representative generalisations are regarded as the sole priority

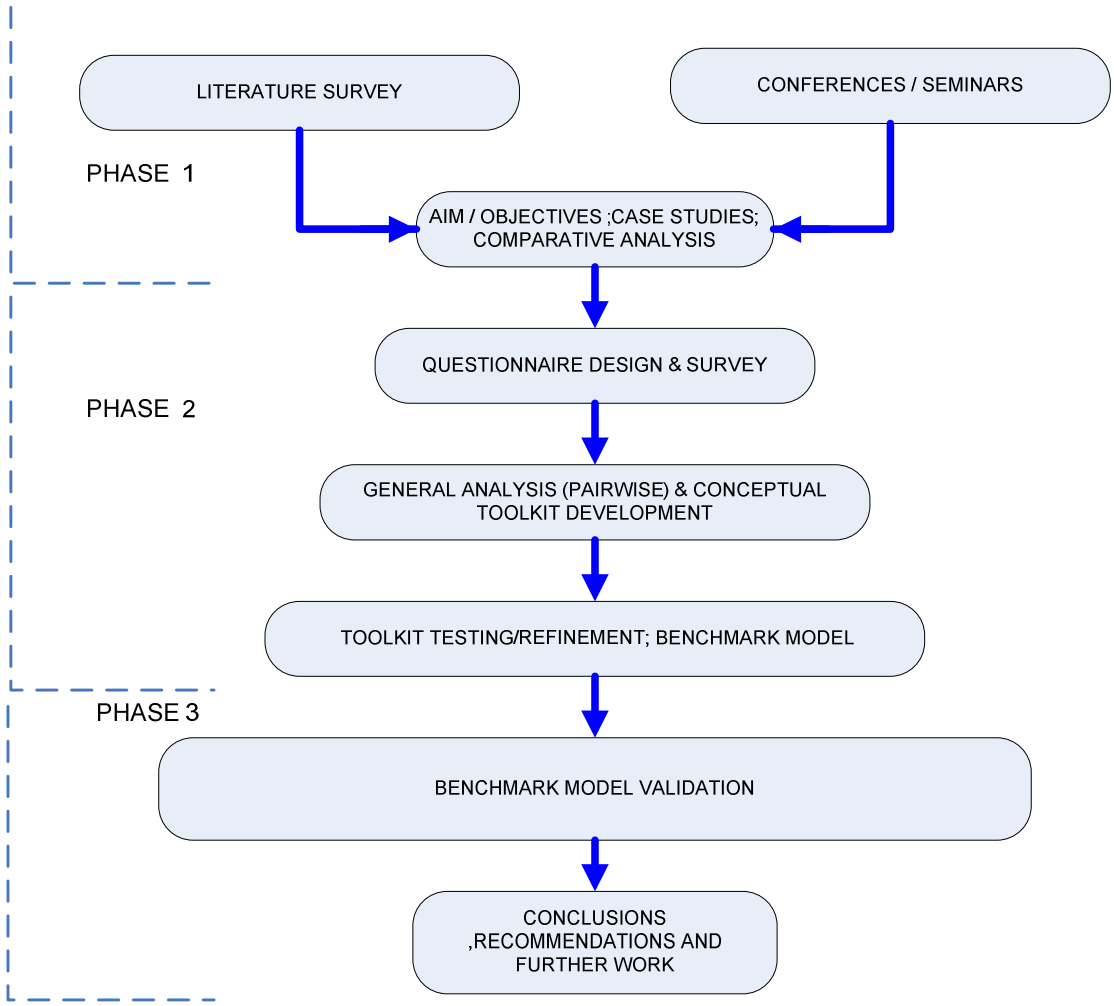

Figure 4.7: Research Methodology

4.15 DATA INTEGRATION AND ANALYSIS

Earlier during the process of data collection in this research, qualitative and quantitative codebooks were developed based on a unified underlying coding structure adopted for this research. Bazeley (2002) explained that 'codes are the means by which data are transferred from one format into another or between QDA and statistical software'. Coding was adopted in this research as a unifying

factor for the two different data sources. Hence, qualitative data was integrated with quantitative data by means of firstly transcribing all qualitative themes obtained through the questionnaire survey into quantitative numerical values through codes to capture the trend. When the trend is captured, it is interpreted and becomes the fundamental bases upon which the qualitative data is derived. However, the bulk of the analysis was done using comparative technique within case study technique. As part of the series of tests carried out in the process of developing benchmark model, correlation of the two principal sets of data were carried out to determine to what extent they reconcile with each other.

4.16 MODEL IMPLEMENTATION / EXPERT PANEL EMPIRICAL (ACTION RESEARCH FEEDBACK)

To ascertain to what extent the proposed benchmark model accomplished its set objectives an expert panel feedback was solicited by e-mail from practitioners on the schemes studied. This was done to close up the last loop of triangulation and confirm the earlier findings on the schemes. For this purpose, the Affordable Housing Quality Toolkit (AHQT) developed in section 8.3 was used in re-assessing 2 (two) of the 10 (ten) affordable housing case studies considered in this research. Confirmatory information was collected from these two case studies to validate the proposed Affordable Housing Quality Benchmark (AHQB) Model. The information was collected as a complementary follow-up feedback data from the expert panel responsible for the sampled schemes earlier studied. In addition, telephone discussions and comments were also drawn concerning the use of AHQB Model on these 2 schemes (case studies) for validation. All these were

essential for validation purposes.

All qualitative data collected were coded and interpreted qualitatively using the toolkit. Janssen (1992) characterized the approach as being relatively simple:'... the overall scores are calculated as the weighted average of the standardized scores'.

4.17 CHAPTER SUMMARY

In the foregoing text of this chapter, sequence of conducting this research has been clearly presented. It shows that the type of data collected in this study is largely textual and structured; the logic employed, deductive; the type of investigation, exploratory; the method of analysis, largely interpretive; the approach to explanation, process theory; and the underlying paradigm, positivist and interpretive.

It also shows the procedure for conducting this study as follows: (1)Documentation-(2)Questionnaire Survey-(3)Case Studies-(4)Data Integration-(5)Analysis-(6)Model Development-(7)Tests and Validation. The identified impacts are greatly the driving factor in the development of good quality Affordable Housing; hence, they are pivotal to developmental drive for this research. Comparative study on quality of Affordable Housing projects; some construction toolkits and benchmark models leading to development of hypothesis were conducted by assessing impact factors. For the purpose of limitation, the impact factors focused in this research are: Technology,

Economical, Sociological and Environmental. As the research advanced through comparative analysis to the subsequent phase of data analysis, there was need for questionnaire data collected from national survey for testing qualitative data from case-studies.

The foregoing shows application of sequential exploratory design with taxonomy technique for the development of benchmark model. It was also essential to guarantee consistency of the developmental process through satisfaction of research hypothesis. Though, thorough assessment of impacts on quality of affordable housing in UK is essential in this research, the use of the findings of impact assessment study is of greater priority for determining the inefficiency of each quality standard. Nevertheless, this was highly instrumental for developing an efficient benchmark model for impact assessment of affordable ousing.

CHAPTER 5

5.0 CASE STUDIES: SAMPLES OF UK AFFORDABLE HOUSING SCHEMES AND QUALITY STANDARDS

5.1 INTRODUCTION

Samples of UK qualitative standards and affordable housing projects assessed by these standards are investigated in this chapter. The quality standards used in assessing these schemes were:

- Commission for Architecture and the Built Environment (Build for life) Standard;
- UNHABITAT Best Practice Standard;
- Housing Corporation (Schemes Development Standard);
- Housing Corporation Decent Homes Standard; and
- ECOHOMES/Sustainable Housing Standard.

Each of these five (5) standards was used to assess two affordable housing schemes. So, ten (10) affordable housing schemes were assessed in overall. Each case study (below) consists of a discussion of a quality standard and assessment of two (2) affordable housing schemes using same standard.

An in-depth case study involving four out of these ten (case studies) schemes was conducted. The reason for a smaller number was to ensure that the schemes are thoroughly examined to reveal all the details of the criteria/or parameters impacting on them. These four schemes are as highlighted in the table 5.1 below. The reason for limiting the study to these four was sufficient to capture all relevan

Table 5.1 Affordable Housing Projects and Measuring Quality Standards

Affordable Housing Projects	Case Study	Quality Standards
CASPAR 1 (Birmingham)	1	Commission For Architecture And Built Environment (CABE)
Park Central Zone 1, Birmingham	2	
Rolls Crescent Hulme, Manchester	3	United Nations Habitat Standard
West Yorkshire Affordable Housing		
Affordable Housing Leeman Road, York	4	Housing Corporation Schemes Development Standard.
Affordable Housing Rawcliffe Grange, York		
Sherrydon Housing, Cranleigh		Housing Corporation Decent Homes Standard
Grove Road, Hindhead		
Old Apple Store, Stawell, Somerset		ECOHOME/ Sustainable Homes Standard
North Allington Road, Bridport, Dorset		

5.2 CASE STUDY 1: CASPAR (BIRMINGHAM) HOUSING SCHEME

This housing scheme was assessed using CABE (Build for Life Standard). It consists of 4 parameters and 19 criteria altogether. In this study, two schemes assessed with this standard were considered, namely as CASPAR (Birmingham) Housing Scheme and Park Central Zone 1.

5.2.1 CABE (Build for Life Standard)

CABE 'Building for Life' Standard was approved by the UK government as a national standard for the general assessment of all kinds of building quality. It was developed by the Commission for Architecture and Built Environment (CABE). The CABE procedure for developing 'Build for Life' Standard is focused greatly on

Technological issues using design and spaces for solving ergonomically oriented problems. The CABE 'Building for Life' Standard comprises of 20 questions (criteria) in 4 categories. These criteria have been used successfully by CABE for auditing various types of housing developments in England including affordable Housing.

There is a significant need for measuring individual criteria to identify this to the quality outcomes. Roche (1999) explained that impact assessment can be based on quantitative or qualitative information. This research is based on qualitative information with the use of various key performance indicators (KPI). The (KPI) or parameters for assessment by means of CABE are in question format as follows:

5.2.1.1 Character

Does the scheme feel like a place with its own identity?

Does the layout create street enclosure appropriate to context?

Do public spaces feel safe?

Is there legible built form?

Does the scheme utilise existing buildings, landscape features or topography?

5.2.1.2 Roads, Parking; and Pedestranisation

Does the building spatial layout take priority over the roads layout?

Does the layout promote use of the streets by those not in cars?

Is car parking situated so as not to detract from the street scene?

Does the scheme integrate with existing roads, paths and development?

5.2.1.3 Design and Construction

Is the design specific to the scheme?

Do buildings exhibit strong architectural quality?

Is there appealing public realm?

Are public spaces well designed?

Has the scheme made use of advances in construction technology?

Are space standards and layouts sufficient to allow for adaptation/conversion or extension?

5.2.1.4 Environment and Community

Does the development have easy access to public transport?

Has the development any features that reduce environmental impact?

Is there a tenure mix that reflects the needs of the local wider community?

Is there a range of accommodation that reflects the needs of the wider community?

Does the development have features to help knit the community?

- (CABE, 2005b)

5.2.2 SCHEME 1: CASPAR Birmingham Project Background

CASPAR I is located close to Birmingham city centre and is situated in an area mainly used for business and manufacturing purposes, though it is a high rise council housing development, high density private developments are also located nearby as seen on figure 5.1. It also aims at contributing to a greater mix of uses in the city centre, thereby increasing the area's vitality.

With the recognition of the growth of single person households in the declining inner city areas, Joseph Rowntree Foundation (JRF) was committed to an experimental design approach with this project. Apparently, demands for the flats, and customers' response to 'affordable homes' close to the workplace and also to the city centre was very positive. This demonstrates how viable this type of accommodation was in Birmingham. Design implications were more complex in CASPAR I, and subsequently led to drawing ideas from the initial project which was experimental. This is on the edge of Birmingham's historic Jewellery Quarter, where substantial regeneration has taken place since 1997.

Figure 5.1: Location map of CASPAR (Birmingham)

Figure 5.1 shows the location map of the four story residential high rise block within a busy city neighbourhood. (CASPAR I) is also known as (City-Centre Apartments for Single People at Affordable Rents). It is a pioneer development of one-bedroom flats which was specifically designed to respond to the need for affordable housing of young singles and couples working in the Birmingham city centre. Figure 5.2 shows the front and the side views of the scheme facing a crowded neighborhood apparently, with no controlled access, thus undermining security

Figure 5.2: Picture showing front and side view of CASPAR (Birmingham)

5.2.3 Technological Impact Assessment

CASPAR 1 has its parking space located on the left of the residential block and also at the ground floor, which makes the scheme highly accessible. Figure 5.3 reveals balconies projecting from the back of the living rooms to each dwelling unit at all floors. This is essentially a good design feature. The roof design, though symmetrical with the shape of the side walls and lifted high to allow for adequate natural lighting of the interior without an overbearing cost of lighting through artificial means (Please refer to figure 5.4 below). In table 5.2, the cumulative score of technological impact was captured considering to what extent the criteria listed were fulfilled in the scheme.

Figure 5.3: The back of CASPAR facing the canal

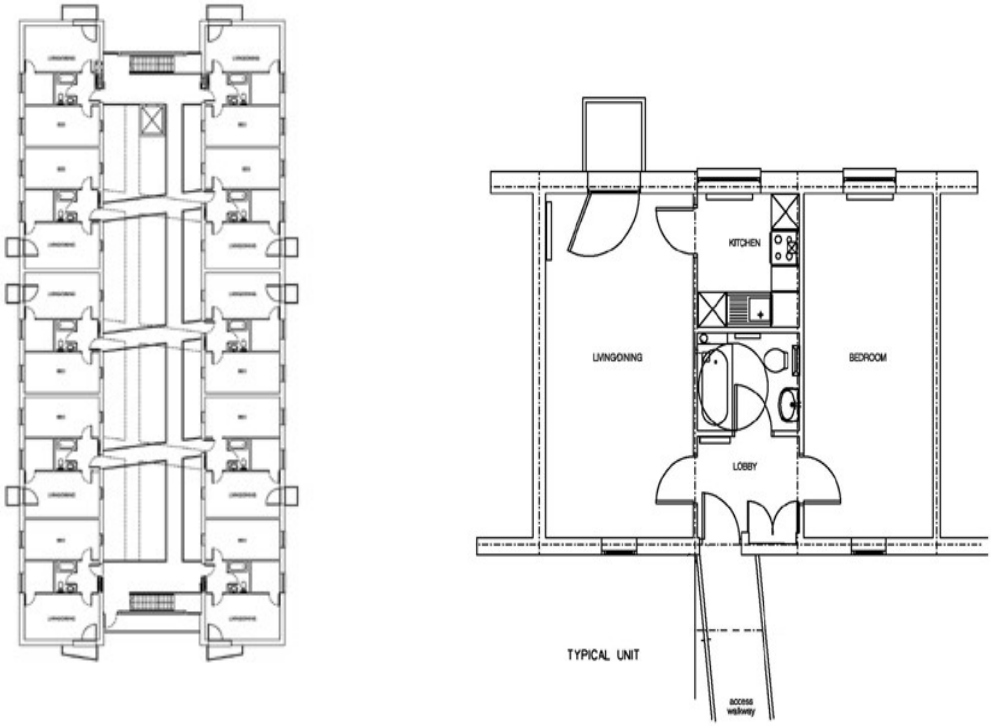

Figure 5.4: Typical floor plan (right)/cross-section (left) of CARSPAR 1

Table 5.2 CASPAR Technological Impact Quality Scores

CODING	TECHNOLOGICAL IMPACT PARAMETERS (Tq)											OVERALL BEST SCORE
	Innovativeness (*p1*)	Design Optimization(*p2*)	Form and Character(*p3*)	Accessibility(*p4*)	Space(*p5*)	Uses(*p6*)	Adaptability(*p7*)	Style(*p8*)	Performance(*p9*)	Engineering(*p10*)	Construction	
Tcs	0	2	3	3	3	4	4	3	4	4	3	4

5.2.4 Sociological Impact Assessment

CASPAR contributed to creating a greater mix of uses in the centre, thereby increasing the vitality of the area. There is no evidence of strong social bond or communal life arising from the design consideration. CASPAR 1 is providing 46

(one-bedroom) flats in four story building for only singles with parking below. This makes it socially exclusive. Figure 5.4 shows a typical section and a floor plan for two opposite rooms. This figure illustrates the quality of space distribution and relationship, hence determining how socially integrating or not the rooms are to each other.

Table 5.3 CASPAR Sociological Impact Quality Scores

CODING	SOCIOLOGICAL PARAMETERS (Sq)				OVERALL BEST SCORE
	Social Inclusiveness(*p12*)	Social Cohesiveness(*p13*)	Policy-compliant (*p14*)	Security/Crime Control (*p15*)	
Scs	5	3	5	3	5

5.2.5 Economical Impact Assessment

Demand for the flats is a positive manifestation of in customers' response to 'affordable' homes close to their workplace and city centre. This location is of high economic impact to inhabitants who save on the cost of travel to and from work.

Table 5.4 CASPAR Economical Impact Quality Scores

CODING	ECONOMICAL PARAMETERS (Eq)							OVERALL SCORE
	Job Creation(*p16*)	Waste Recycling(*p17*)	Use of Economical Materials(*p18*)	Water Optimization(*p19*)	Energy Optimization (*p20*)	Sustainability(*p21*)	Subsidy-Free(*p22*)	
Ecs	1	1	2	2	2	2	2	2

5.2.6 Environmental Impact Assessment

The scheme has a canal located to its back and charlotte street in front which could serve as a mode of transportation for the inhabitants. This makes the scheme also accessible by boat in addition to land access. It has its back against the Birmingham and Fazeley Canal and the front to Charlotte Street. The street was mainly built up with some commercial and office buildings and derelict sites used for parking cars. Figure 5.5 shows ideal parking space with easy access and egress to adjoining road network

Figure 5.5: The drive-in leading to parking space as seen from the left.

Table 5.5 CASPAR Environmental Impact Quality Scores

CODING	**ENVIRONMENTAL PARAMETERS (Evq)**							**OVERALL BEST SCORE**
	Zoning(*p23*)	Pollution Control(*p24*)	Local-Material Contents(*p25*)	Health and Safety(*p26*)	Waste Disposal(*p27*)	Circulation(*p28*)	Transportation(*p29*)	
Evcs	4	3	4	3	3	4	4	4

5.3 CASE STUDY 2: PARK CENTRAL ZONE 1, BIRMINGHAM

Park central Zone 1 is the second scheme of the case studies conducted in this research. It was assessed with the use of CABE toolkit. Its performance was highlighted within four impact factors seen below.

5.3.1 Park Central Zone 1, Birmingham-Project Background

Park central zone 1 affordable housing is part of Park Central residential, commercial and leisure project being developed over 10 years. It is covering about three hectares of parkland. It is part of the regeneration of the wider Atwood Green area. It will provide nine different residential zones and four business quarters as well as shops, restaurants and a landmark hotel. The entire project is planned to accommodating 1800 new residential units with genuine mix of uses. The main objective of this project is to physically**,** economically and socially regenerate what was formally a wasted and dangerous no-go parkland area.

Before 1940 Park Central was a close network of back to back terraced housing, local businesses, shops, pubs, schools and hospitals. By late 1950s most of the housing was cleared as a result of damages recorded at the site after bombings during the Second World War. It was replaced with an irregular mix of low, medium and high-rise houses and apartments for 30 years by the local authority, which was set around parkland.

In the 90s, parkland was turned into a safe haven by drug dealers and thus a no-go area for the public. In mid 1990s Birmingham City Council stock transferred most

of the housing to Optima Community Association, which was a regeneration agency and housing association. Three story apartment blocks is aligned along Wheelys lane and Bath Lane. Another U-shaped block of apartments located on the corner of Wheelys lane and Lea Bank Middleway as shown in figure 5.5 below. Figure 5.6 shows optimal utilization of building design intermingling with street networks.

Figure 5.6: Panaromic view of a section of the neighbourhood cluster

Figure 5.7: The Approach view of Mews Cottages at Park Central Zone 1

5.3.2 Technological Impact Assessment

Park Central Zone 1 is characterized by perimeter apartment blocks facing the main road. These blocks are imposing, robust and hard edged in contrast to more intimate and playful design within the mews and boulevard sections development protected by the perimeter blocks.

Figure 5.8: First Floor Plan of Mews Cottages at Park Central Zone 1

Figure 5.9: Floor Plans of Boulevard Houses at Park Central Zone 1.

The block layout makes going round the scheme very easy. These blocks are also massed together at such a high density of (155 dwellings per hectare) next to the city centre which benefits the inhabitants. The design is such that the balconies from the apartment blocks; windows and terraces from the Boulevards and mews units are overlooking the external and internal roads and parking courts, hence increasing security. There were good considerations for a blend of building forms

with efficient manipulation of building designs to create clusters of units with adequate setbacks as seen in figures 5.7 and 5.8. Space relationship, uses and accommodation was also made good as shown in figures 5.9 and 5.10 with site area and density of 1.86 hectares at 130 units per hectare.

Figure 5.10: The Overall Layout Plan of Park Central Zone 1

Figure 5.11: A section of Park Central, Zone 1 layout plan

Parking ratio for types of dwelling units has houses 100% to apartments' 60%. Typical accommodation for a dwelling unit area of 3 bed affordable mews houses is 86.7 sq.m and 2.5 sq.m storage. The layout plans shown in figures 5.10; 5.11 And aerial view in figure 5.12 below are clear indications of the level of controlled access and ease of circulation within and around the dwelling units.

Figure 5.12: Aerial view of the neighbourhood cluster

Table 5.6 Park Central Zone 1 Technological Impact Quality Scores

CODING	TECHNOLOGICAL IMPACT PARAMETERS (Tq)											OVERALL BEST SCORE
	Innovativeness (*p1*)	Design Optimization(*p2*)	Form and Character(*p3*)	Accessibility(*p4*)	Space(*p5*)	Uses(*p6*)	Adaptability(*p7*)	Style(*p8*)	Performance(*p9*)	Engineering(*p10*)	Construction Technique(p11)	
Tsc	0	2	4	4	4	4	4	4	4	4	3	4

5.3.3 Sociological Impact Assessment

The accommodation types in Park central Zone 1 are mainly of flats and houses in a mixed use arrangement**.** The number of dwelling units is I80 private and 63 affordable housing. There were 32 houses, 148 apartments (private) and 30

houses, 33 two bed apartments (affordable). This mix is socially inclusive. Also the communal play area in Figure 5.13 fosters social cohesiveness of the inhabitants as they get to know each other and get on well through frequent meeting at the playground.

Figure 5.13: Playing area attached to Park Central Zone 1

Table 5.7 Park Central Zone 1 Sociological Impact Quality Scores

CODING	**SOCIOLOGICAL PARAMETERS (Sq)**				**OVERALL SCORE**
	Social Inclusiveness(*p12*)	Social Cohesiveness(*p13*)	Policy-compliant (*p14*)	Security/Crime Control (*p15*)	
Scs	5	3	5	3	5

5.3.4 Economical Impact Assessment

In Park Central Zone 1 one off cost per unit of 2 bed apartment ranges from £152,000; 3 bed house from £245,000 and 4 bed from £250,000 to £265,000. The use of material has no direct bearing on reduction of one off cost of the dwelling

units. Though, the scheme is located about 10 minutes walk to city center where there are job opportunities, which is a positive economic impact, other sources of income were not considered for the inhabitants. Waste recycling and other cheap sources of energy supply were not also considered in this scheme. Also, there was no provision for family lots (garden) which could be used to support families feeding expenses. The economical impact score for park central zone 1 scheme are particularly low as seen in table 5.8 below.

Table 5.8 Park Central Zone 1 Economical Impact Quality Scores

CODING	ECONOMICAL PARAMETERS (Eq)							OVERALL BEST SCORE
	Job Creation(*p16*)	Waste Recycling(*p17*)	Use of Economical Materials(*p18*)	Water	Energy Optimization	Sustainability(*p21*)	Subsidy-Free(*p22*)	
Ecs	1	1	2	2	2	2	2	2

5.3.5 Environmental Impact Assessment

The environmental impact of zoning Park Central Zone 1 to the existing location is highly advantageous as it is located within easy proximity to most services like the train station bus station, schools, city centre etc. The materials used for construction which is mainly brick and glass are also environmentally friendly. Waste pollution control is also considered in the scheme. Circulation and Pedestrian walkways are also positioned properly. The zoning of the site is highly advantageous as it is in close proximity to transportation means and other relevant services. Figure 5.9 shows that environmental impact is fairly moderate.

Table 5.9 Park Central Zone 1 Environmental Impact Quality Scores

CODING	ENVIRONMENTAL PARAMETERS (Evq)							OVERALL BEST SCORE
	Zoning(*p23*)	Pollution Control(*p24*)	Local-Material Contents(*p25*)	Health and Safety(*p26*)	Waste Disposal(*p27*)	Circulation(*p28*)	Transportation(*p29*)	
Evsc	4	3	3	3	3	4	4	4

5.4 CASE STUDY 3: ROLLS CRESCENT SCHEME, HULME, MANCHESTER

5.4.1 Use of UNHABITAT Standard

The use of UNHABITAT standard for best practice award in housing quality assessment was made manifest in some UK affordable housing schemes. Two of such schemes are being studied here. They are the Regeneration of Hulme in Manchester and the West Yorkshire affordable Housing. The procedure applied by UNHABITAT in their best practice Award was focusing mainly on sociological and economical impacts aimed at eradicating poverty and introducing economical sustainability.

The parameters for assessment under UNHABITAT standard are as follows:

- Architecture and Urban Design
- Infrastructure, Communications/Transport
- Children and Youth
- Land Use Management

- Civil Engagement and Cultural Vitality
- Older Pensions
- Disaster and Emergency
- Poverty Eradication
- Economic Development
- Housing
- Environment Management
- Production and Consumption Pattern
- Gender Equity and Equality
- Social Services
- Technology Tools and Methods
- Urban Governance
- Urban Regional Planning
- Use of Information In Decision Making

5.4.2 Rolls Crescent Scheme, Hulme Project Background

The improvement of living conditions and restoration of pride in Rolls Crescent, affordable housing, Hulme was part of bigger Hulme Regeneration conducted by Manchester city council. Hulme is a Manchester inner city area previously notorious for its poor housing conditions and crime. In common with much of northern Europe, housing was developed in the 1950s and 1960s on a large scale with the aim of dealing with shortage and providing large numbers of satisfactory homes for the homeless and for those living in slums. Because little thought was given to the nature of the old public housing or its environment, much of it now has been demolished. The site lies within the area developed as the infamous crescent

blocks of the 1960's. Since 1991, under Hulme City Challenge, the area has undergone total regeneration. Rolls Crescent is a built response to the Hulme Design Guide and it could be said that this development provokes the sense of community and spirit expressed in the Guide.

5.4.3 Technological Impact Assessment

The Rolls Crescent development at Hulme demonstrates how design flair can deliver a very wide range of dwelling types within a coherent street scene. Hulme is a typical example of how Urban Design Code can be used in developing new buildings. The scheme's regeneration programme produced about 1,000 high quality homes to rent, two parades of shops, workshops and a health centre. Over 1,000 homes for sale schemes were integrated in blocks among the rented homes in an area where previously people were not prepared to buy homes. There are many positive aspects to Rolls Crescent in Hulme. Among these are: The varied building heights as shown in figure 5.13 below. Also the enhanced corner treatment helps to create positive focal points along both sides of the street and defining the character of the place. The front doors face directly onto the street, improving public surveillance.

Figure 5.14: Varieties of roof capes with good blend of dwellings types

The building line is behind a two-metre deep buffer zone, which provides space for rubbish, storage, meter boxes, cycles, and allows for personalisation. This design also reinforces the public/private divide. Arguably a negative aspect of the development is the small size of private and communal gardens as partly shown in figure 5.17, although, the communal space does lend a sense of cohesive community to the development. Figure 5.16 shows provision of two meter wide zones at the frontage for a secured balcony. This space allows for installation of electric meter box; trashes bin/recycled storage. These are good design features that provide solution to problems, thereby creating positive technological impact for the scheme. Figure 5.15 below further explains how forms and character are exploited in the design of this scheme. Table 5.10 shows distribution of quality criteria under technological impact for Rolls Crescent Scheme in Hulme, Manchester.

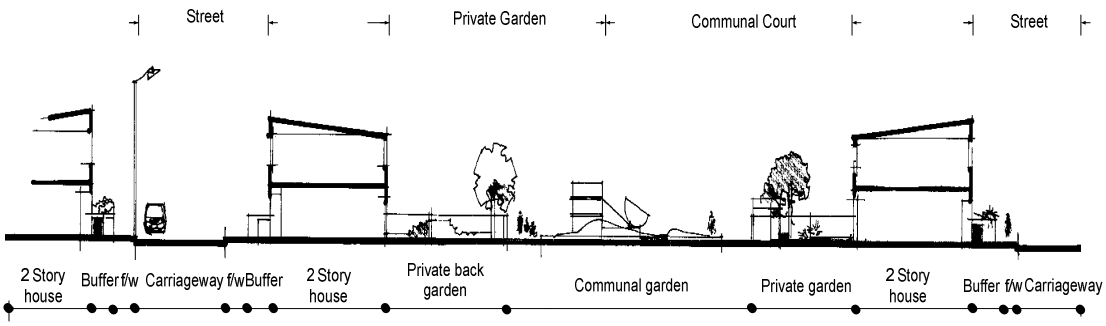

Figure 5.15: Section through Rolls Crescent, Hulme, Manchester. ECD Architects (1997)

Figure 5.16: Secured Balcony at Rolls Crescent, Hulme, Manchester

Figure 5.17: Front courtyard space at Hulme Scheme

Table 5.10 Roll Crescent, Hulme Technological Impact Quality Scores

CODING	TECHNOLOGICAL IMPACT PARAMETERS (Tq)											OVERALL BEST SCORE
	Innovativeness (*p1*)	Design Optimization(*p2*)	Form and Character(*p3*)	Accessibility(*p4*)	Space(*p5*)	Uses(*p6*)	Adaptability(*p7*)	Style(*p8*)	Performance(*p9*)	Engineering(*p10*)	Construction Technique(p11)	
Tcs	0	0	3	4	3	4	4	3	3	4	3	4

5.4.4 Sociological Impact Assessment

Hulme has now been reconstructed all over again but the new social housing which is essential to meet the needs of people on low incomes is this time developed with the involvement of local people, taking full account of their views. It was built in context and includes other elements essential to a viable community. The new community emerged from the previous one, retaining 80% of the existing residents. The Hulme redevelopment process was therefore designed to succeed the old. Within the scheme of 67 dwellings, there are 11 different dwelling types ranging from three-storey, 5-bedroom houses to single-storey 2-bedroom units designed to be wheelchair accessible. This makes the scheme a socially inclusive and sustaining one by creating a more stable community, it also provides the circumstance where long term issues such as sustainability can begin to be examined. The front courtyard system as indicates in figure 5.18 below also promotes sense of security and crime checks from among residents.

Figure 5.18: Front courtyard space of Hulme Scheme.

In conjunction with the City Council, a different planning brief was agreed which aims to develop homes of high quality but which reflect their urban environment and create a close-knit community where casual meetings and contacts are more likely to occur and there is more of a feeling of a shared environment for which all the residents have responsibility rather than each resident having an isolated defensible space. Social inclusiveness ranks highest followed by social cohesiveness; policy compliance and security/crime control as shown in table 5.11.

Table 5.11 Roll Crescent, Hulme Sociological Impact Quality Scores

CODING	**SOCIOLOGICAL PARAMETERS (Sq)**				**OVERALL BEST SCORE**
	Social Inclusiveness(*p12*)	Social Cohesiveness(*p13*)	Policy-compliant (*p14*)	Security/Crime Control (*p15*)	
Scs	5	4	4	4	5

5.4.5 Economical Impact Assessment

The use of the Hulme development to create opportunities for local employment and training was considered as part of the regeneration programme. This therefore helped provide employment closer to the inhabitant.

Social housing must be affordable by people on low incomes. If they cannot afford their rent without state support out of the wages they can earn, they may not be able to improve their circumstances by working since the wages will simply replace the lost state support. The homes at Hulme have been given a level of grant which enable existing local authority rent levels to be matched.

Table 5.12 Roll Crescent, Hulme Economical Impact Quality Scores

CODING	ECONOMICAL PARAMETERS (Eq)							OVERALL BEST SCORE
	Job Creation(*p16*)	Waste Recycling(*p17*)	Use of Economical Materials(*p18*)	Water Optimization(*p19*)	Energy Optimization (*p20*)	Sustainability(*p21*)	Subsidy-Free(*p22*)	
Ecs	4	1	2	2	4	3	4	4

5.4.6 Environmental Impact Assessment

This scheme was adjacent to the ‘‘Little Ireland’’ described in Friedrich Engels’ “The Condition of the Working Classes in the smoke from a dozen tall factory chimneys ” (Symes, 1998). Presently, this kind of environmental pollution has improved. The new homes will reduce carbon dioxide emissions by at least

1,000,000 kg per year and also replaced energy inefficient homes with ones requiring far fewer resources to heat.

The bus routes and roads give better access to nearby amenities and hopes for a future link to the tram system. The layout in figure 5.19 below shows a good circulation. A new city park, public open space and links to the canal basin. A public art installation, "Signs of Life", developed in close collaboration with local people who chose the artist and participated in workshops and further elements to follow in stained glass and bronze.

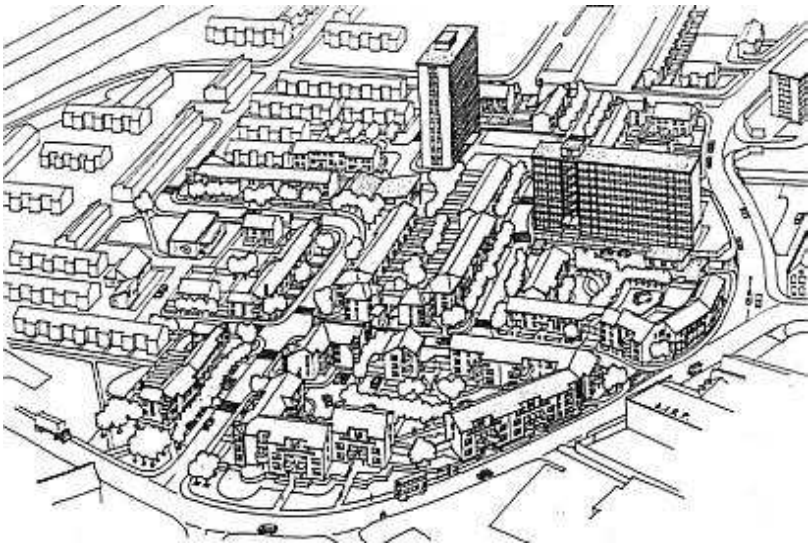

Figure 5.19: Layout of Rolls Crescent Affordable housing, Hulme.

Figures 5.20 and 5.21 below show the pedestrian walk way at Hulme which serves as a buffer between the street and the building line. This makes mix circulation of pedestrian and vehicular objects a lot easy with boost in environmental impact.

Table 5.13 Roll Crescent, Hulme Environmental Impact Quality Scores

CODING	ENVIRONMENTAL PARAMETERS (Evq)							OVERALL BEST SCORE
	Zoning(*p23*)	Pollution Control(*p24*)	Local-Material Contents(*p25*)	Health and Safety(*p26*)	Waste Disposal(*p27*)	Circulation(*p28*)	Transportation(*p29*)	
Evsc	4	4	3	4	3	3	3	4

Figure 5.20: On street parking space

Figure 5.21: Road net works with their walkways

5.5 CASE STUDY 4: ST PETER'S QUARTER, LEEMAN ROAD SCHEME

5.5.1 Housing Corporation Scheme Development Standard (HCSDS)

One of UK standards for measurement of housing quality is Schemes Development Standard (SDS). It was developed by Housing Corporation. This standard has its criteria primarily focusing on space measurements; use of spaces; maintainability and accessibility of housing projects. Most of the projects assessed with this quality standard are refurbished projects.

The parameters for assessment under Housing Corporation Schemes Development Standard are as follows:

- Minimum floor areas
- Electrical Socket provision
- Storage
- Circulation space

5.5.2 St. Peter's Quarter, Leeman Road Scheme Project Background

St Peter's Quarter, Leeman Road, York was developed by Taylor Wood plc for Wilson Connolly (Northern) with support from York City Council. Leeman Road area of York consists primarily of 19th century ex-railway workers' houses. It was extremely prone to flooding both from the River Ouse and the adjacent Holdgate Beck. In 1978, 225 houses were seriously flooded.

Figure 5.22: A Road network of St Peter's Quarters, Leeman

5.5.3 Technological Impact Assessment

St Peter's Quarter, Leeman Road development has a crescent layout, which gives it a sense of place and a strong identity. Its crescent layout which was set around an open space contributed in giving it a distinct character. Individuality of the design was enhanced by external treatments and variations in building heights. With a good mix of dwelling types, ranging from apartment to town houses as shown in figure 5.22, St Peter's Quarter was able to achieve desired form and character of the place. The development's crescent layout was clearly defined by higher buildings at corners. The individuality of the development was also enhanced by high quality architectural detailing. These detailing were greatly emphasized at around the windows and balconies. In 1980 a flood bank was constructed in front of the houses to protect them from flood water.

Figure 5.23: A typical family dwelling units at Leeman Road

The sewage system was also improved drastically, allowing sewage to be pumped when the river levels were high. During the 1982 flood, high winds blowing over Clifton Ings generated large waves which overtopped the Leeman Road defenses. The flood bank was raised in response to this effect. This was acclaimed good technological innovation positively aimed at saving lives and properties. Figure 5.23 above shows good access to one of the family dwelling units at Leeman Road

Table 5.14 St Peter's Quarter Scheme Technological Impact Quality Scores

CODING	TECHNOLOGICAL IMPACT PARAMETERS (Tq)											OVERALL BEST SCORE
	Innovativeness (*p1*)	Design Optimization(*p2*)	Form and Character(*p3*)	Accessibility(*p4*)	Space(*p5*)	Uses(*p6*)	Adaptability(*p7*)	Style(*p8*)	Performance(*p9*)	Engineering(*p10*)	Construction Technique(p11)	
Tcs	0	3	4	4	4	4	4	4	4	4	4	4

5.5.4 Sociological Impact Assessment

St Peter's Quarter, Leeman Road, consists of 229 homes, among which are good mixes of one, two three and four bed apartments. The density of this development is 62 dwellings per hectare (d.p.h.). These are typically positive sociological impact criteria. Though the back of the dwelling units are lined with metal grid fence which offers a limited security as seen in figure 5.24, this does not offer sufficient required security.

Figure 5.24: The back of the dwelling units lined metal grill fence

The location of the scheme as presented in figure 5.25 greatly exploits both good road network; circulation and proximity to different transportation modes, yet the security of some dwelling units were undermined due to no proper consideration for the flood plane in their design which predisposes some dwelling units to occasional flooding from adjoining River Ouse.

Figure 5.25: Aerial view of St Peter's Quarters, Leeman Road. Layout

Table 5.15 St Peter's Quarter, Sociological Impact Quality Scores

CODING	SOCIOLOGICAL PARAMETERS (Sq)				OVERALL BEST SCORE
	Social Inclusiveness(*p12*)	Social Cohesiveness(*p13*)	Policy-compliant (*p14*)	Security/Crime Control (*p15*)	
Scs	3	3	5	3	5

5.5.5 Economical Impact Assessment

The landscape was well planned with a lot of communal open spaces and semi-mature trees. This also includes kick about areas and private gardens which is used to support families with provision of fresh garden fruits and vegetables. Apparently, location of the scheme at a 5 minute walk to city centre makes inhabitants easily accessible to jobs at the city centre which are within easy

proximity to the scheme. Table 5.16 indicated the economical impact scores for the scheme.

Table 5.16 St Peter's Quarter Scheme Economical Impact Quality Scores

CODING	ECONOMICAL PARAMETERS (Eq)							OVERALL SCORE
	Job Creation(*p16*)	Waste Recycling(*p17*)	Use of Economical Materials(*p18*)	Water Optimization(*p19*)	Energy Optimization (*p20*)	Sustainability(*p21*)	Subsidy-Free(*p22*)	
Tcs	2	2	2	2	2	2	2	2

5.5.6 Environmental Impact Assessment

There are a combination of on-street, rear court and integrated garages. These varieties serve to break up the monotony of its impact. The location of the scheme is five minutes walk from the city center, hence making it economical for the residents to get to city centre. The parking system adopted is a mix of on-street, rear courts and garages. The flood bank which was constructed in front of the houses to protect them from flood water was a positive environmental impact. The circulation within the scheme was well planned and made good. Figure 5.26 shows good transport network and circulation for the scheme. This is responsible for high scores recorded under such environmental criteria.

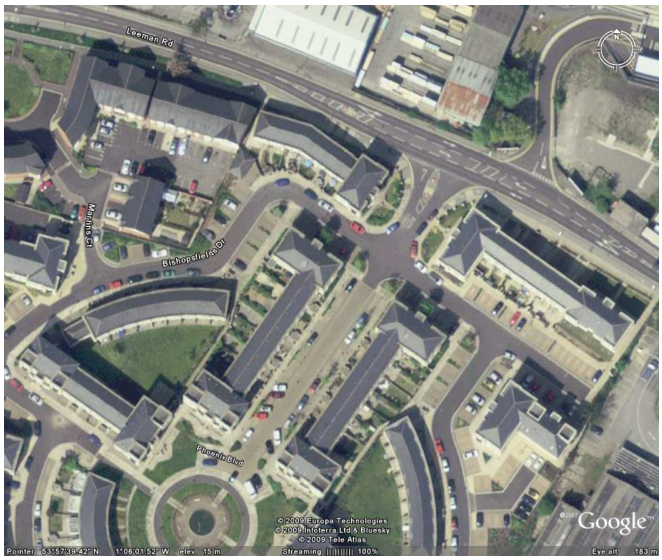

Figure 5.26: A layout plan of St Peter's Quarters, Leeman Road

Table 5.17 St Peter's Quarter Leeman Environmental Impact Quality Scores

CODING	ENVIRONMENTAL PARAMETERS (Evq)							OVERALL SCORE
	Zoning(*p23*)	Pollution Control(*p24*)	Local-Material Contents(*p25*)	Health and Safety(*p26*)	Waste Disposal(*p27*)	Circulation(*p28*)	Transportation(*p29*)	
Evsc	4	2	3	3	3	4	5	5

5.6 CHAPTER SUMMARY

This chapter presented a study of 4 samples out of 10 affordable housing schemes that were selected from the initial list of 84 identified schemes. The essence of studying 4 schemes is to be able to capture as much details of the scheme as possible. Hence, these little details were thoroughly examined to determine to what extent they influenced the schemes. The quality standards and criteria with which they were assessed were also explained. Technological; sociological; economical and environmental impacts arising from the schemes due to the designs, planning, after use performance and other criteria were also succinctly examined and contributed to overall quality output.

CHAPTER 6

6.0 DATA COLLECTION, INTERGRATION AND ANALYSIS

6.1 INTRODUCTION

This chapter reports on the data collected in the course of the research and their analyses. The exploratory and interdisciplinary nature of this research warranted both qualitative and quantitative data. Several scholars have suggested for greater integration of methodological approaches also known as the mixing of methods (Achen and Snidal, 1989; and Tarrow, 1995).

It is essential to determine the sources of each type of data before proceeding with this chapter. Qualitative data in form of texts and themes and quantitative data in numeric form were collated. Principal source of qualitative data in this chapter was through case study conducted on affordable housing projects and for quantitative data, it was through questionnaire survey conducted with practitioners.

Affordable housing case studies were reported in chapter 5 and qualitative data output from these case studies were analysed and captured in qualitative codebook. Weighting was attached to the data output by transcribing the themes into qualitative values. Levels of quality criteria as seen on the case studies were recorded and valued according to their impact level. The research analysis framework is shown in figure 6.1 indicating the stages of the analysis. The quantitative analysis (on the left) was started with the identification of basic

quality criteria within affordable housing samples, while the qualitative analysis (on the right) was started with selection of affordable housing projects to be measured. However, the converging point is at the development of a unified standard of measurement ranging 0-5 (No Impact-Highest Impact), while the final point is the benchmark development and validation.

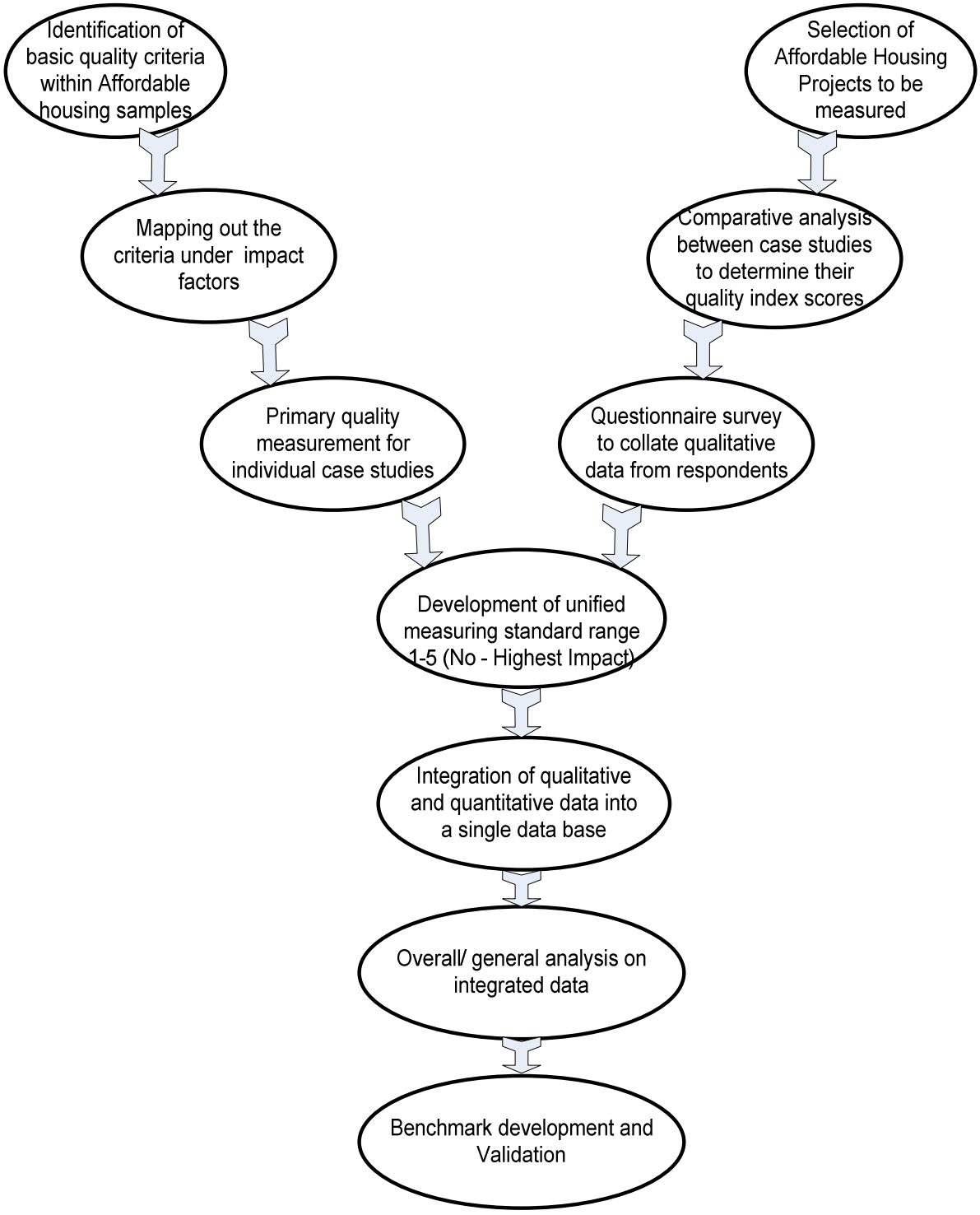

Figure 6.1: Research Analysis Framework

6.2 GENERATION OF QUALITATIVE DATA FROM SAMPLED PROJECTS

A list of 10 samples of UK affordable housing projects was drawn from the initial list of 86. These samples were further grouped into five (5) according to influencing Quality Standards. This was essential in order to determine the pattern of influences of quality on these samples. An in-depth study focusing on assessing these samples based on four principal factors outlined in this study was conducted. These impact factors have varying number of constituent parameters, which in turn have varying number of constituent criteria. The quality level of each affordable housing scheme is determined by the number of quality criteria achieved relative to the total number in each parameter. This computation resulted into values which can be seen in the codebook in table 6.1. The outcome of the exercise presented qualitative data extract or qualitative codebook in this research study.

6.2.1 Sorting of documents and visual data

A huge volume of data was gathered while screening data from various sources in the case studies. It was thereafter transcribed and captured numerically thereby scaling down the size to a manageable size. It is essential that the two sources of data are converted to uniform medium to facilitate integration. Relevant documents, photographs and drawings for description and analysis of the sample schemes were carefully selected and arranged in sequential order. For instance, the order may range from aerial photographs in form of 'Google' maps-site layout-site plan-building layout-building plan-flat plan to room plan. This was relevant

for orderly and detailed analysis of the schemes. Figure 6.2 shows how twenty nine (29) criteria were generated for assessing the affordable housing schemes.

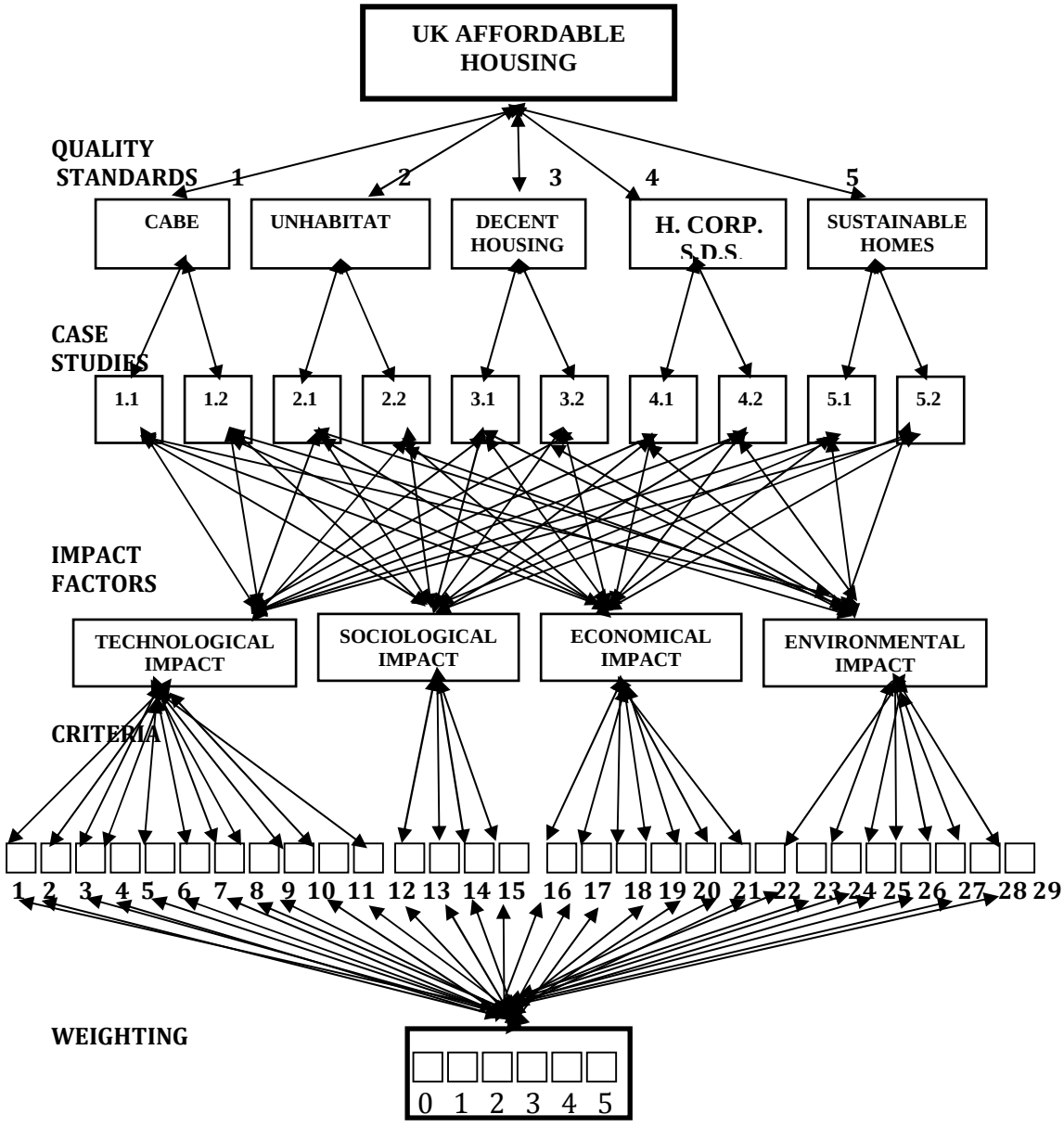

Figure 6.2: Impact Measuring Scale for Quality Standards

6.2.2 Sampling of Affordable Housing Schemes

Extreme or deviant sampling technique was adopted in collating documentary evidence of previous impact evaluation on sampled affordable housing projects in the UK. This technique involves seeking out the most outstanding cases, or the most extreme successes and/or failures, so as to learn as much as possible about the outliers (Tashakkori and Teddlie, 2003, p.280).

Therefore, notes were taken of previous evaluations conducted by experts using indicators within various recognized UK quality standards. It was significant to capture the originally assessed level of quality for each project. Out of 87 affordable housing schemes (projects) identified within the UK, ten were selected representing two project samples each, from 5 identified quality standards. Selection was done by considering the projects that have been assessed with UK operational quality standards (QS) and have won award within respective categories. Table 6.1 indicates the projects sampled and their associated quality standards (QS) categories. Each scheme was skewed towards satisfaction of the criteria set by the Quality Standard with which it was assessed.

6.2.3 Development of a Qualitative Codebook.

Miles and Huberman's (1994) idea of coding qualitative data was adopted in the developing qualitative code book in this research analysis. A codebook is defined, as a statement of the codes for database, which can be generated during a project and may rely on codes from past literature (Cresswell, 2007). The sample projects case study was first categorized according to the quality standards (QS) used in assessing each.

Performance indicators for each (QS) were also identified and linked with impact criteria and mapped out against each sample project.

All codes from qualitative data used in this analysis are shown in the qualitative codebook with these notations:

- T*q*= Technological Impacts from sample projects
- S*q*= Sociological Impacts from sample projects
- E*q*= Economical Impact from sample projects and
- Ev*q*= Environmental Impacts from sample projects.

Accumulation of the codes within impact factors for each case study as indicated in the sample projects' quality output were indicated in qualitative codebook for affordable housing in Table 6.1.

The relative ranking of the impact factors between the samples were determined by first calculating the total number of criteria considered in each impact factor and then comparing it with the number present in each sample. These scores were then transformed into importance indices to assess the relative rankings for the impact factors based on the formula (1) below (Love and Haynes, 2001; Olomolaiye *et al*., 1998; Okpala and Aniekwe, 1998; Shash, 1993; Holt, 1997; Kometa *et. al*., 1994).

$$\text{Relative importance index} = \frac{\sum w}{AN},\ (0 \le QII \le 1) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Whereas (*w) represents* the weighting cumulated by each impact factor as determined by the summation of all quality outputs of the criteria within the impact factor; (*A*)

represents the highest possible quality output for the scale and (*N*) represents the total number of criteria in each impact factor; as shown on the toolkit. The range of scores is from 1 to 5 (with '1' as 'very low impact' or 'least important' and '5' as 'highest impact' or 'the most important')

The total number of criteria for technological impact factor is 11; sociological impact factor is 4; economical impact factor is 7 and environmental impact is 7). A comparison of the quality output for all samples within the quality their respective standards shown in Table 6.1 resulted in the overall best quality output for all parameters. When this was calculated using the above formula, it yielded relative importance indices as shown in table 6.2.

Table 6.1: Qualitative Codebook for sampled affordable housing schemes

PARAMETERS	QUALITY STANDARDS										
	CABE STANDARD		UNHABITAT STANDARD		HOUSING COPORATION STANDARD		DECENT HOMES STANDARD		ECOHOME STANDARD		BEST OVERALL SCORES
(T*q*) TECHNOLOGICAL	(C.S.)		(C.S.)		(C.S.)		(C.S.)		(C.S.)		
	1.1	1.2	2.1	2.2	3.1	3.2		4.2	5.1	5.2	
Innovativeness	0	0	0	0	0	0	0	4	4	4	4
Design Optimization	2	2	0	0	3	0	0	4	4	4	4
Form and Character	3	4	3	3	4	3	3	3	3	3	4
Access	3	4	4	3	4	3	3	4	4	4	4
Space	3	4	3	3	4	3	3	3	3	3	4
Uses	4	4	4	3	4	4	3	3	3	4	4
Adaptability	4	4	4	3	4	4	3	3	3	3	4
Style	3	4	3	3	4	4	3	3	3	3	4
Performance	4	4	3	4	4	4	3	3	2	4	4
Engineering	4	4	4	3	4	3	3	3	3	3	4
Construction Techniqu	3	3	3	3	4	4	4	3	4	3	4
SOCIOLOGICAL (*Sq*)											
Social Inclusiveness	5	4	5	5	3	4	3	3	3	3	5
Social Cohesiveness	3	3	4	4	3	4	3	3	3	3	4
Policy-compliant	5	5	4	3	5	5	5	5	3	3	5
Security/Crime Control	3	4	4	3	3	3	3	4	3	3	4
ECONOMICAL (E*q*)											
Job Creation	1	1	4	4	2	2	3	2	3	3	4
Waste Recycling	1	1	1	1	2	2	2	2	3	3	3
Use of Economical Mate	2	2	2	2	2	2	2	3	3	3	3
Water Optimization	2	2	2	2	2	2	2	3	4	4	4
Energy Optimization	2	2	4	4	2	2	2	4	4	4	4
Sustainability	2	2	3	2	2	2	2	3	4	4	4
Subsidy-Free	2	2	4	3	2	2	2	2	4	3	4
ENVIRONMENTAL (EV*q*)											
Zoning	4	4	4	3	4	3	2	4	4	4	4
Pollution Control	3	3	4	4	2	4	2	4	4	4	4
Local-Material Content	4	3	3	3	3	2	2	4	4	4	4
Health and Safety	3	3	4	3	3	3	3	3	4	4	4
Waste Disposal	3	3	3	3	3	3	3	3	4	4	4
Circulation	4	4	3	3	4	3	3	3	4	3	4
Transportation	4	4	3	3	5	3	3	4	4	3	4

6.2.4 Comparison of projects quality measure adopting Quality Function Deployment(QFD) Technique.

The measurements obtained from sampled Affordable housing projects were compared with each other to determine quality impact level. The measurements obtained for the impact factors relate to the case study projects and were respectively compared to each other to obtain the best possible group. The pairwise comparison technique was adopted for this purpose. This method is known as 'method of constant comparison' and was adopted by Glaser and Strauss (1967) which was also the underlying principle behind the Quality Function Deployment (QFD) technique. The best group of impact levels were synthesised from the case studies. The first phase of investigative studies conducted on sampled projects revealed a wide range of success criteria responsible for their quality. Variations of impact levels were identified from one sample to another, according to the strength of their impacts. This variation gave rise to ranks as shown in Table 6.2, depending on how significant it is highlighted in each sample. The quality output as seen in this table will later be used for unidimentionality; scale reliability and converge validity.

Table 6.2: A relative comparison of the Importance Indices of the ten (10) housing schemes

Project Case Studies		Technological Impacts		Sociological Impacts		Economical Impacts		Environmental Impacts	
		Ranks	Relative Importance Index	Ranks	Relative Importance Index	Ranks	Relative Importance Index	Ranks	Relative Importance Index
1	C. S. 1.1	6	0.600	2	0.800	9	0.343	5	0.714
2	C. S. 1.2	3	0.672	3	0.800	10	0.343	1	0.800
3	C. S. 2.1	8	0.564	1	0.850	3	0.571	6	0.686
4	C. S. 2.2	9	0.509	5	0.750	5	0.514	8	0.629
5	C. S. 3.1	1	0.709	7	0.700	7	0.400	7	0.686
6	C. S. 3.2	7	0.581	4	0.800	8	0.400	9	0.600
7	C. S. 4.1	10	0.509	8	0.700	6	0.429	10	0.514
8	C. S. 4.2	4	0.655	6	0.750	4	0.543	2	0.800
9	C. S. 5.1	5	0.655	9	0.600	1	0.714	3	0.800
10	C. S. 5.2	2	0.690	10	0.600	2	0.686	4	0.743

6.3 EXTRACT OF QUANTITATIVE DATA FROM THE QUESTIONNAIRE

6.3.1 Determination of numeric values for data coding

The coding of quantitative data was similar to the coding of qualitative data. The range and themes they represent are from 0-5 or 0(No Impact) 1(lowest impact)-2(Low Impact)-3(Average Impact)-4(High Impact) to (Very High Impact). However, the scale here was sub-divided in tens for each band. Each band covers between ten digits (e.g. Lowest Impact band starts from +0.0 to +0.9). This calibration is vividly shown in figure 6.3 and table 6.3 and was used in designing the questionnaire.

6.3.2 Screening; Cleaning; and Encoding of quantitative data.

Quantitative data collation was obtained from questionnaires which were sent to practitioners or developers involved in the development of the ten (10) affordable housing schemes investigated in the case studies. The questionnaire can be seen in appendix A. Due to the deviant sampling technique adopted in this study, there was need to screen, clean and encode the quantitative data obtained before proceeding to the next stage. The first stage to cleaning the data was separating the general questions from 'key impact' questions. The general questions were analysed separately to reveal the professions to which the respondents belonged; the number of schemes they have been involved in; the percentage of the scheme they were involved that was affordable; and their years of experience in the business. The 'key impact' questions were analysed separately to determine the impact scores for validation purposes. The supposition is that if the practitioners were at their best, this will reflect in their product. Hence, the outcome of their efforts in terms of impact levels should be equal to the outcome of their products in terms of impact levels. For ease of identity, the questions were coded as represented in table 6.3 and collaborated by figure 6.3.

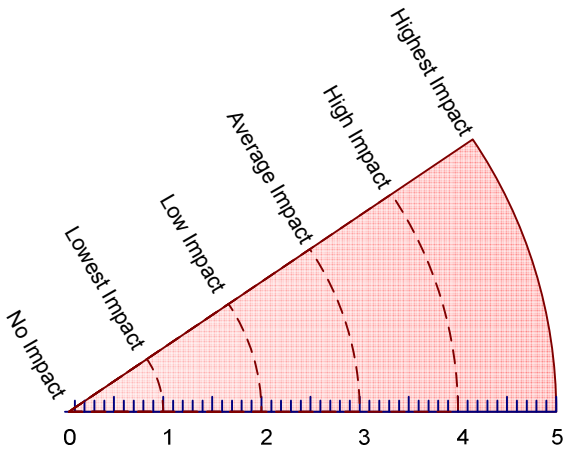

Figure 6.3: Numeric Equivalent to Qualitative Description

Table 6.3: Codified Impact Weights Used In the Study

No	CODES	PERCENTAGES EQUIVALENT	THEMATIC PHRASES FOR CODING	
			PROJECT C. STUDIES	QUESTIONNAIRE RESPONDENTS
1)	0	0%	No Impact	Void
2)	1	0-20%	Lowest Impact	No Opinion
3)	2	21-40%	Low Impact	Strongly Disagree
4)	3	41-60%	Average Impact	Disagree
5)	4	61-80%	High Impact	Agree
6)	5	81-100%	Highest Impact	Strongly Agree

The figure 6.4 shows the distribution of respondents' responses to the questionnaire survey. From the data west midlands has greatest number of response, followed by London. The East England and the South East have 5.5%, being the least response rate. This data explains the rationale behind west midlands performance, being that the study was carried out in the region.

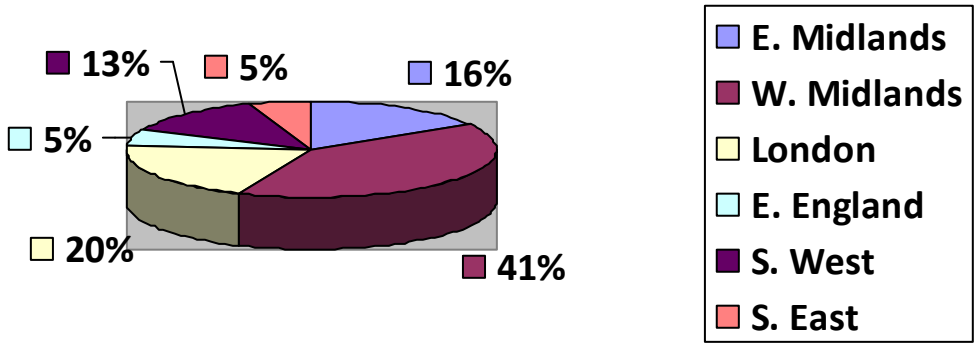

Figure 6.4 Distributions of Respondents to Questionnaire Feedback

From figure 6.5 the distribution of respondents in the supply chain category shows that out of all the respondents that participated in the questionnaire, 69.2% were Architects; 5.8% were Contractor while 25% were Developers.

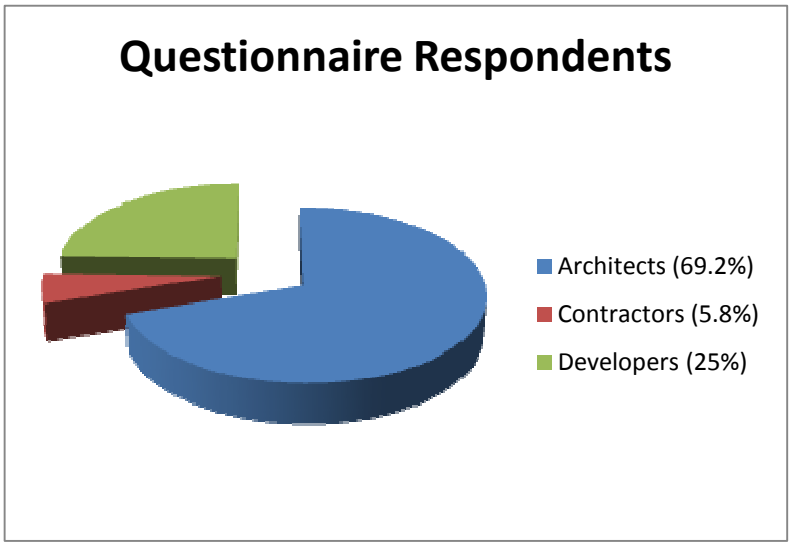

Figure 6.5: Array of respondents in supply chin category

6.3.3 Checking for Quantitative Trends and Distribution

Pairwise comparison of design components in table 6.5 show an array of data derived from the questionnaire survey requesting for relative importance for all the design components to the practitioners. From the result, greatest number of practitioners are in favour of access and layout as their most preferred component while designing affordable housing.

Table 6.5: Pairwise comparison of design components

AFFORDABLE HOUSING QUALITY VARIABLES		Access	Space	Use	Performance	Engineering	Construction Technique	Forms/Materials	Character/Innovation	Environment	Layout Planning
Access	**1**										
Space	**2**	1									
Use	**3**	1	2,3								
Performance	**4**	1,4	4	4							
Engineering	**5**	1	2	3	4						
Construction Technique	**6**	1	2	3	4	6					
Forms/Materials	**7**	1	2	3	4	7	7				
Character/Innovation	**8**	1	2	3	4	8	8	7,8			
Environment	**9**	1,9	9	9	4,9	9	9	9	9		
Layout	**10**	1,10	10	10	4,10	10	10	10	10	9,10	

A break down of the relative importance of this figure resulted in the following output:

- Access /Lay-out (1/10) =9(Highest rank);
- Environment (9) =8
- Performance (4) =7
- Space /Use (2/3) =5
- Forms/Materials /Character/Innovation (7/8) =3

- Construction Technique (6) =1(Lowest rank)
- Engineering Services (5) =(No Score).

The number after each component indicates the rank or position as recorded by data output from respondents. Whereas many secured a single position, some had two positions. This breakdown shows that access is of utmost importance to the respondents in designing their affordable housing projects, while Engineering Services is of least importance to them.

The significance of quantitative data from practitioners in this research lies in its ability to capture the intangible aspects of the project under study which is difficult to capture, even during physical observation. These aspects include issues like the use of construction toolkits; construction process; and application of certain building materials. Qualitative data collected by this method, therefore becomes an integral part of data for this research. Creswell and Plano-Clark (2007) suggested the relevance of pre-data analysis at respective data type level before a general analysis which comes after data integration. The idea at this level is not to capture all the variables (materials) shown on the matrix but to capture the commonly used materials for samples under study. This pre-general data analysis resulted in relative importance matrix as shown in table 6.1 below. The distribution in the matrix shows the level of importance attached to each building material. This shows the aggregate of materials commonly used for construction of good quality affordable housing.

Table 6.6: Relative Importance Index for Building Materials

COMPONENT	RANK	BUILDING MATERIALS APPLICATION	APPROVAL RATING
FOUNDATION	1	Use of Concrete at the foundation	0.8
	2	Use of Masonry at the foundation	0.3
	3	Use of other unlisted building materials at the Foundation	0.2
	4a	Use of Metal at the foundation	0.1
	4b	Use of Polyester-based/P.V.C./Plastic product a foundation	0.1
FLOOR	1	Use of Concrete for the floor	0.7
	2	Use of Timbre for the floor	0.4
	3	Use of Masonry for the floor	0.1
WALL	1	Use of Masonry for the wall	0.8
	2	Use of Timbre for the wall	0.5
	3a	Use of Metal for the wall	0.1
	3b	Use of glass for the wall	0.1
	3c	Use of other unlisted building materials for the Wall	0.1
DOOR	1	Use of Timbre for the door	0.6
	2	Use of Polyester-based/P.V.C./Plastic products for the door	0.3
	3	Use of other unlisted building materials for the Door	0.1
WINDOW	1	Use of Timbre for the window	0.7
	2a	Use of Polyester-based/P.V.C./Plastic products for the window	0.3
	2b	Use of glass for the window	0.3
	3	Use of Metal for the window	0.2
	4	Use of other unlisted building materials for the Window	0.1
CEILING	1	Use of gypsum for the ceiling	0.8
	2	Use of Timbre for the ceiling	0.2
	3	Use of Metal for the ceiling	0.1
ROOF	1	Use of Slates for roof cladding	0.5
	2a	Use of Use of Polyester-based/P.V.C./Plastic Products for the roof cladding	0.3
	2b	Use of metal for roof cladding	0.3
	2c	Use of concrete for roof cladding	0.3
	3	Use of glass for the roof cladding	0.2
	4	Use of other unlisted building materials for the roof cladding	0.1

A general trend for application of building materials in the construction of affordable housing by developers in the UK was provided as in table 6.6. This table

shows the most predominant building materials in use relative to each building component.

Figure 6.6 shows the relative years of experience of respondents to the questionnaire. While respondents with 1-5 years experience constitutes 6% of the total figure recorded, there was no respondent without experience. This result shows a great reliability considering the calibre of respondents to the questionnaire.

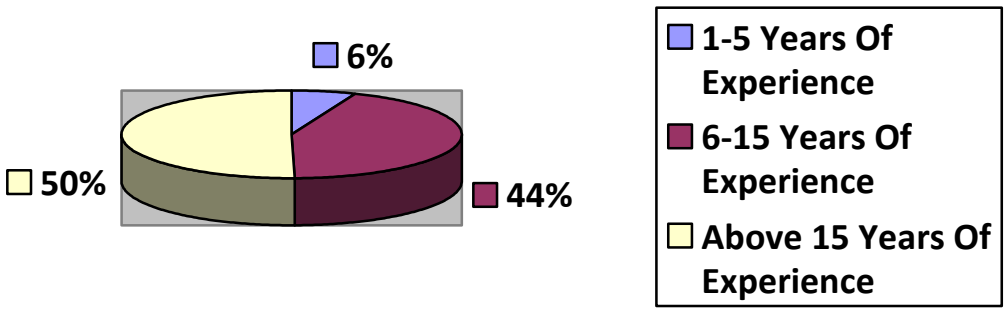

Figure 6.6: Respondents' years of experience in the affordable housing sector

In addition to years of experience in delivering affordable housing, some respondents have also secured some years of experience in market housing, while some others have their field of experiences only in the non-market housing. Figure 6.7 shows the years of experience for respondents in delivery of market housing type. A pre-data analysis result here shows a record of 44% for respondents with 6-15 years of experience under market housing category and 45% for over 15years

experience. 11% of the data is missing. This result further supports the credibility/quality of respondents, given their over 15 years of experience.

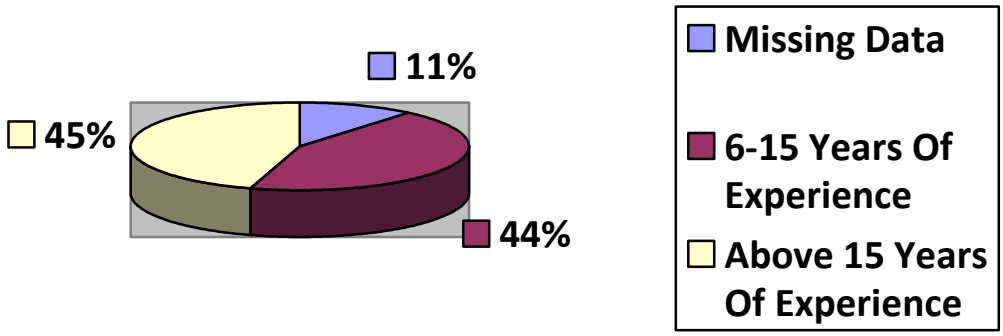

Figure 6.7: Respondents' years of experience in housing sector

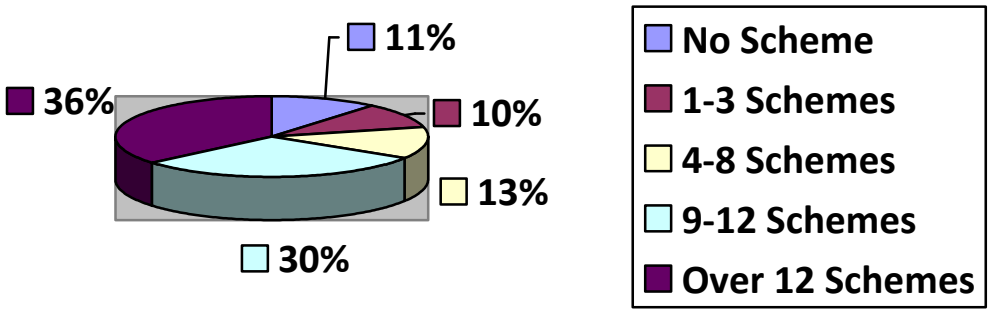

Figure 6.8: Number of Affordable housing schemes built by respondents

Figure 6.7 shows relative levels of quality for all quality components shown in the table 6.6. The index was generated from grouping and coding done on the questionnaire data to categories of indicators. Further to that and for reasons of consistency, these indicators were associated with their respective impact factors. The result shows the distribution of relative quality levels for the four impact factors investigated in this study.

Table 6.7 Cumulative Quality Scores for Samples

Impact Factors	Cumulative Quality Scores from Respondents						Rating					
	Design Quality	Build Quality	Innovative Quality	Cost –saving Quality	Socio-economical Quality	Environmental Quality	Best Quality scores	No Impact	Low Impact	Average Impact	High Impact	Highest Impact
								1	2	3	4	5
Economical Impact(*Ep*)	0.00	1.00	1.29	1.73	2.23	2.60	2.60			*		
Sociological Impact(*Sp*)	5.00	0.00	0.00	0.00	2.62	3.07	5.00					*
Technological Impact(*Tp*)	3.14	2.96	1.84	1.60	0.00	0.00	3.14			*		
Environmental Impact(*Evp*)	3.80	4.00	0.00	0.0	0.0	2.56	4.00				*	

Table 6.8 is a further break-down of the components mentioned in table 6.7. Table 6.8 the figures were broken into ranks to determine the relative importance Index under the four principal factors being investigated in this study. This is significant to capture the weight of these quality components.

Table 6.8: Ranks and Relative Importance Index

Developers' Quality Performance Indicators		Technological Impacts		Sociological Impacts		Economical Impacts		Environmental Impacts	
		Ranks	Relative Importance Index	Ranks	Relative Importance Index	Ranks	Relative Importance Index	Ranks	Relative Importance Index
1	Design Quality	1	0. 628	1	1.000	6	0.0.00	2	0.760
2	Build Quality	2	0. 592	4	0.000	5	0.200	1	0.800
3	Innovative Quality	3	0. 368	4	0.000	4	0.258	4	0.000
4	Cost Control Quality	4	0. 320	4	0.000	3	0.346	4	0.000
5	Socio-Economic Quality	5	0.000	3	0.534	2	0.446	4	0.000
6	Environmental Quality	5	0.000	2	0.614	1	0.520	3	0.512

Interpretation of the results from the two tables 6.7 and 6.8 is interpreted in figure 6.9. The figure shows the analysis based on the cumulative of the quality components investigated through the questionnaire.

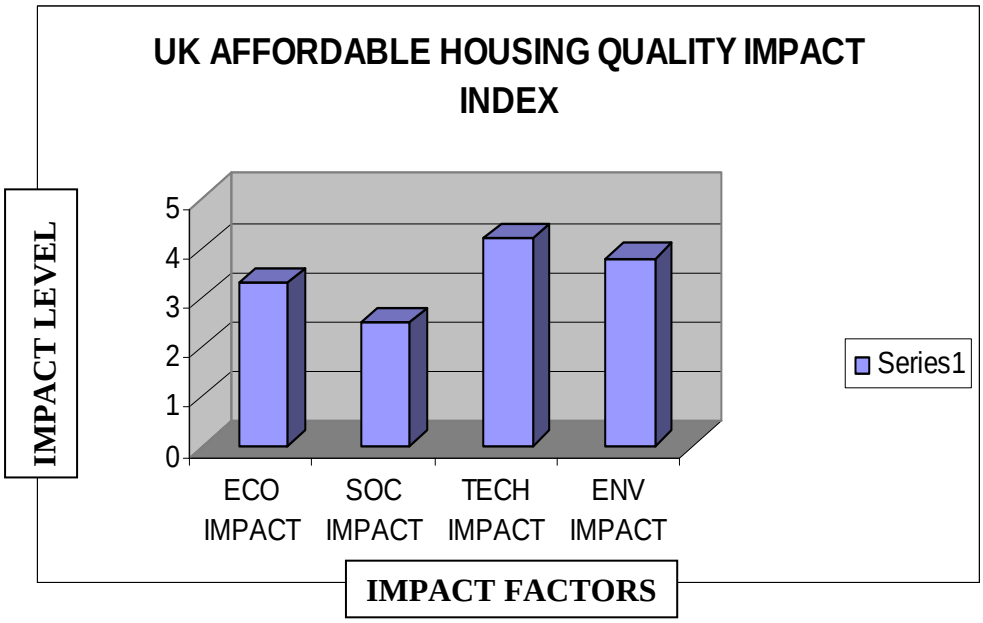

Figure 6.9: Quality Impact Index from Questionnaire Respondents

6.4 CONVERGENCE OF QUALITATIVE AND QUANTITATIVE DATA

6.4.1 Integration of Qualitative and Quantitative Data

Creswell (2003) explains that 'Integration means that the researcher ''mixes'' the data collected from both qualitative and quantitative methods. For example, in data collection, this ''mixing'' might involve combining open-ended questions on a survey with close-ended questions on the survey. Due to adoption of mixed research methods in this study, data integration was relevant to reconcile data collected from both qualitative and quantitative sources. Data integration was done

at the analysis and interpretation stage of this research. Qualitative data obtained through comparative analysis of the case studies was initially transcribed into 'codes' that are recognized by both qualitative and quantitative data. These 'codes' are the standard measurement for both quantitative and qualitative data in this research. The range of the value is from 1(Least) to 5(Highest). The same codes which apply to qualitative data from project case studies also apply to quantitative data from Questionnaire survey. Finally, the measures for the key impact factors under this study were compared between set of case studies and questionnaire data resulting in obtaining a single set of data for both. The comparison draws the best set of quality measurement from the two sets of measurement.

6.4.2 Checking for Correlation of Impact Factors between Questionnaire and Project Case Study Data

Correlation quantifies the extent to which two quantitative variables, X and Y relate to each other. When high values of X are associated with high values of Y, a positive correlation exists. When high values of X are associated with low values of Y, a negative correlation exists. Table 6.10 below represents cross-sectional data set from observations taken on the impact factors of both Questionnaire (practitioners' data) and Project (Case Studies data) sets. For each impact factor, the value of the relative importance index, the rank and the standard deviation were determined.

The X variable is considered to be the mode measurement of the impact factors from the Project Case Studies, while the Y variable is considered to be the mode measurement for the impact factors from the Questionnaire data. The impact factors are aggregate of like quality attributes. Note was taken of the four principle impact factors considered this study. Three significant observations were derived from table 6.2. These observations are: The number of impact factors measured (i.e. n=4); the overall mode of Project Case Study data (i.e. X=0.850); and the overall mode of Questionnaire data (i.e. Y=1.000).

Figure 6.10 below shows a scatter plot correlating case studies and questionnaire data. It reveals that 'Case Studies' Data and 'Questionnaire' Data have positive correlation because high values of X (Measurement of Impact Factors from Questionnaire Data) when associated with high values of Y (Measurement of Impact Factors from Case Studies' Data) shows that a remarkable correlation exist

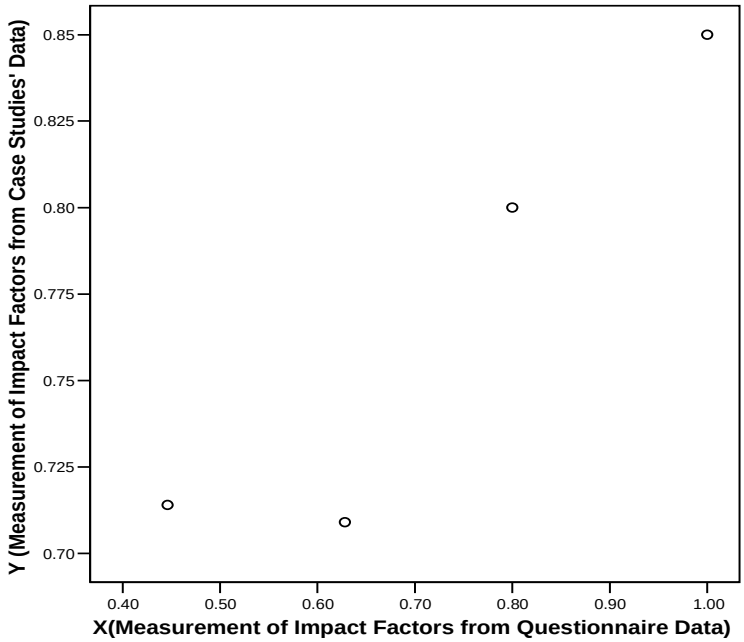

Figure 6.10: Correlation of Case Studies and Questionnaire Data

The exceptional impact factor that could not correlate in the two sets of data was the social impact factor. This was considered as an 'outlier' in this study. An 'outlier' is defined as a value far from most others in a set of data.

Furthermore, there is an aberrant observation (outlier) in the lower right of the quadrant involving social impact factor. This indicates that efforts social impact has not been attracting sufficient relevant attention as other impact factors and so requires to be focused on.

6.5 CHAPTER SUMMARY

In this chapter, the two data sources (Questionnaire and case sample) used were discussed. A questionnaire was mainly used to collect quantitative data, while case studies were mainly used to collect qualitative data. Issues concerning how these data were sourced, screened and pre-analysed individually were also part of this chapter. Finally discussed was how the two analysed data were integrated and correlated. Also highlighted in this chapter, was how the two codebooks were developed for quantitative and qualitative data.

CHAPTER 7

7.0 DEVELOPMENT OF A CONCEPTUAL AFFORDABLE HOUSING QUALITY TOOLKIT

7.1 INTRODUCTION

In this chapter, a customized toolkit that will capture various quality dimensions of affordable housing was conceptualised because each toolkit has its design specific focus and therefore, deficient in areas of minimal focus. Hence, the proposed affordable housing benchmark model requires a toolkit tailored to its specification.

The toolkit consists of four (4) impact factors; each having its parameter; and each parameter has assessment criteria/criterion (see figure 7.1). The components of the toolkit are denoted as follows:

- Impact Factors: Technological (T); Sociological (S); Economical (E) Environmental (Ev).
- Parameters: Parameter 1 (*P1*); Parameter 2 (*P2*)……Parameter 29 (*P29*)
- Criteria/criterion: 1,2,3,4,5,6,7,8,9……..(expandable)

All relevant dimensions and fundamental components of affordable housing quality were considered and incorporated into the framework. Data collected via questionnaire; literature review and case studies conducted were all essential contributors to the toolkit.

In the toolkit, the criteria were grouped under relevant parameters and in turn the parameters grouped under relevant impact factors. However, there are cases were some criteria of similar nature may occur under different parameters or parameters of similar nature may occur under different impact factors because these parameters or criteria are of peculiar character. This means that a parameter or criteria may repeatedly occur twice or more in the toolkit but with different impact and/or impact capacity. The components of the toolkit are now discussed.

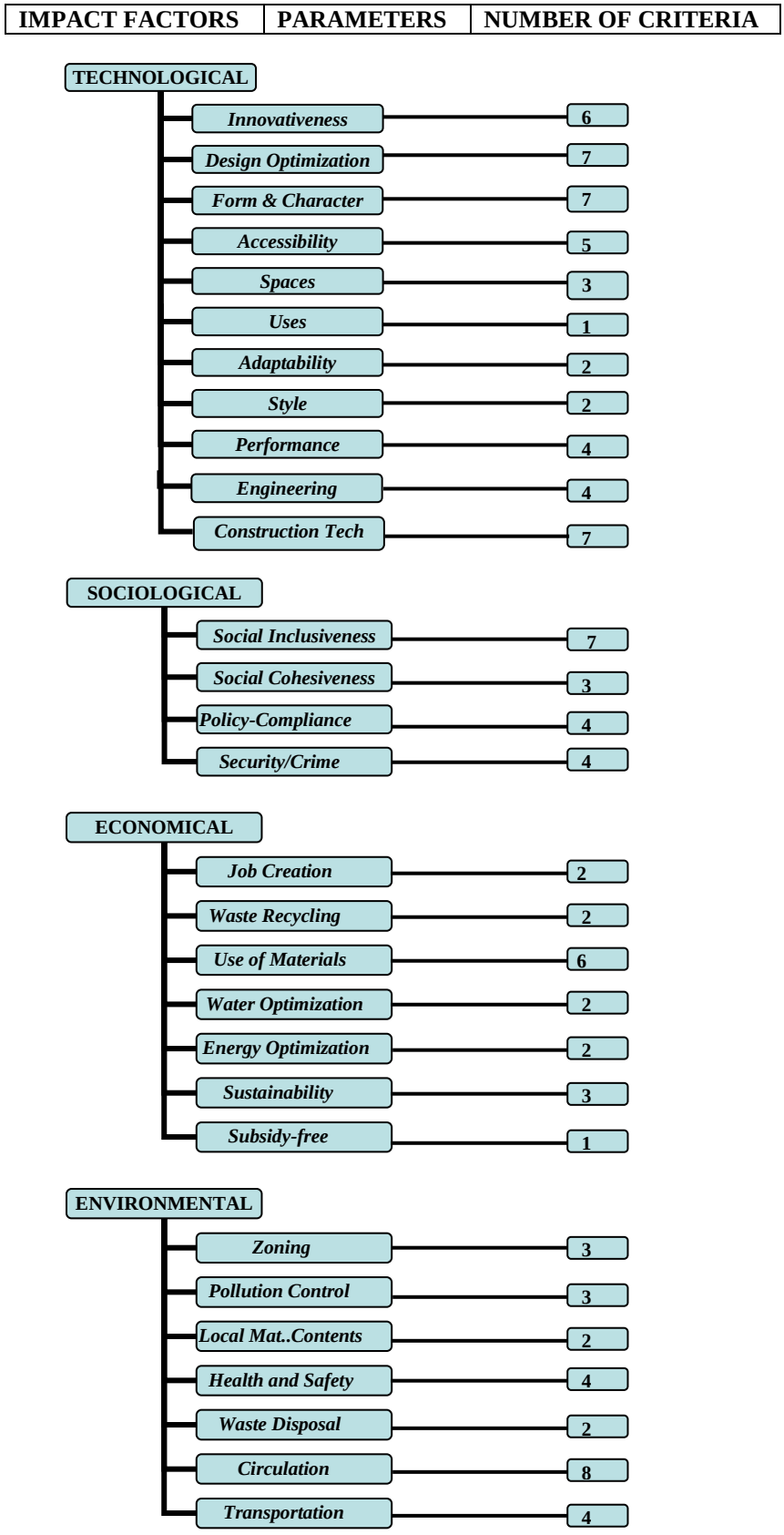

Figure 7.1: A Framework for AHQ toolkit

7.2 PARAMETERS/CRITERIA OF TECHNOLOGICAL IMPACT FACTOR

The technological factor is the capacity of affordable housing to create a sense of place and have positive quality effect on the local community and environment as indicated in the following parameters and their criteria.

7.2.1 Innovativeness (P1)

Innovativeness is a parameter categorized under technological impact factor. It is the capacity for exploiting new technique(s) or idea(s) in contributing to added value to affordable housing scheme. Figure 7.2 highlights innovative parameter with its 6 (criteria) linked to technological factor among other impact factors. It comprises of 6 criteria which are listed below:

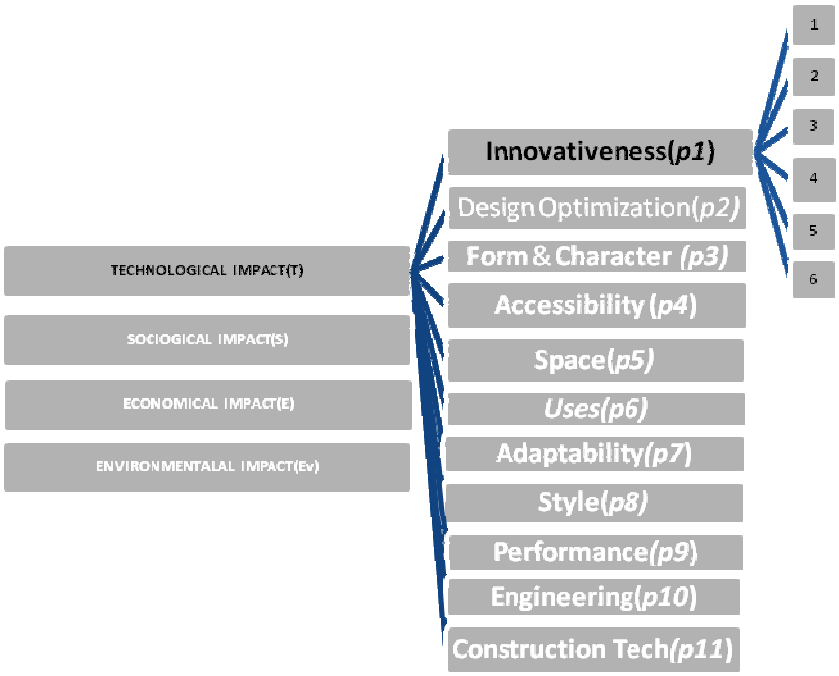

Figure 7.2: Innovativeness

Criteria:

1) Consideration for exploring new technique(s) for energy efficiency.

2) Consideration for exploring new technique(s) for water efficiency.

3) Consideration for exploring new technique(s) for cost reduction.

4) Consideration for exploring new technique(s) for using construction materials.

5) Consideration for exploring new technique(s) for wind exploitation.

6) Consideration for exploring new technique(s) for waste recycling.

7) Consideration for exploring new ideas through design solution.

7.2.2 Design Optimization (P 2)

This is the design process laid down for achieving optimal utility of the primary objectives of quality affordable housing schemes. In this context, design is maximally applied proactively in resolving anticipated problems that may arise within affordable housing scheme. Affordable housing schemes being assessed with this parameter are expected to satisfy any or all of the listed criteria below. Figure 7.3 highlights 7 (criteria) of linked to technological impact factor among other factors.

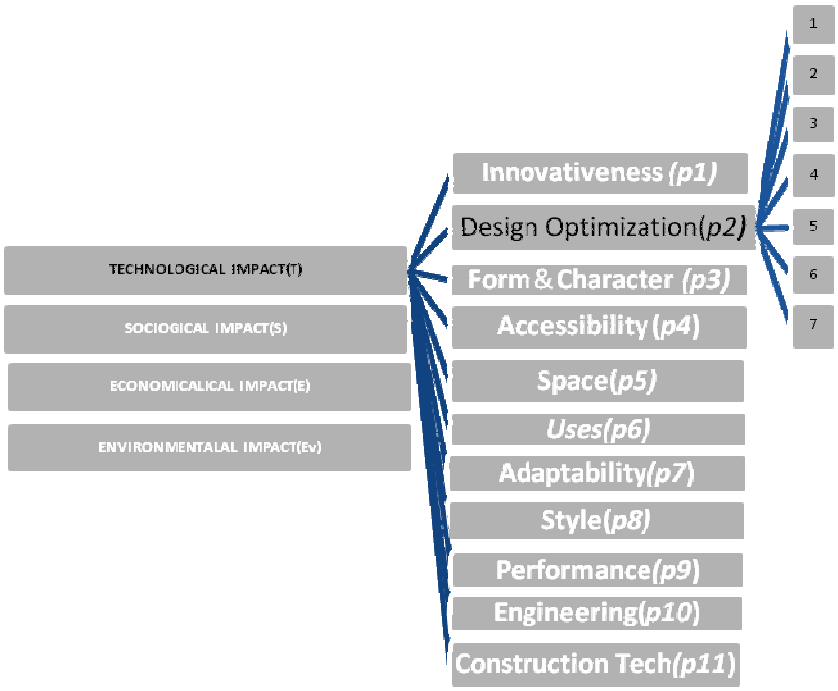

Figure 7.3: Design Optimization

Criteria:

1) Consideration for building orientation such that at least one bedroom window could face east to achieve maximum solar assess during cooler periods in the year.

2) Consideration for locating balconies within building design should be such that it is adjacent to living rooms and between (1m-1.5m) deep.

3) Consideration for balconies should be such that they are not screened with solid walls.

4) Consideration for provision of private open space like patio, porch, deck, balcony or yard.

5) Consideration for traffic calming strategies to slow down cars within the project.

6) Consideration for good acoustics both within and from one dwelling unit to another.

7) Consideration for avoiding large areas of blank wall facing the street.

7.2.3 Form & Character (P3)

This is the capacity for the schemes form(s) to satisfactorily align with that of other buildings in the neighbourhood and the environment. However the affordable housing being assessed under this parameter is expected to satisfy any or all of the listed criteria below. Figure 7.3 highlights the 7 (seven) criteria of the form and character parameter of technological impact factor among the other impact factors.

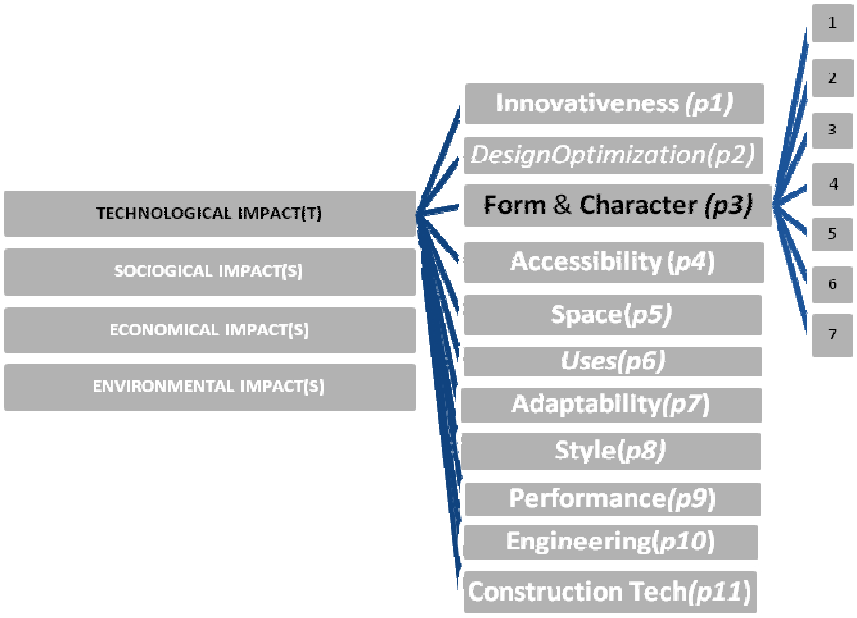

Figure 7.4: Form and Character

Criteria:

1) Consideration for variety of building forms and roof shapes rather than box-like forms with large unvaried roofs.

2) Consideration for efficient manipulation of buildings to create clusters of units, and variations in height, setback and roof shape.

3) Consideration for relating size and bulk of the structure being assessed to 50-100% of other buildings in the neighbourhood spanning of 200m radius.

4) Consideration for relating the entire height of the assessed structure to that of adjacent structures and of the immediate neighbourhood of 200m radius.

5) Consideration for relating floor-to-floor heights to the neighbouring buildings within 200m radius.

6) Consideration for consistency in the relationship between the first floor of the assessed building and the neighbouring buildings to the street.

7) Consideration for relating the size and bulk of the assessed building to the prevalent scale in other buildings within the immediate neighbourhood of 200m radius.

7.2.4 Accessibility (P4)

This is the capacity by all relevant services or facilities attached to any affordable housing scheme to be reached by all people, goods and services. However, affordable housing being assessed under this parameter is expected to satisfy any or all of the following criteria.

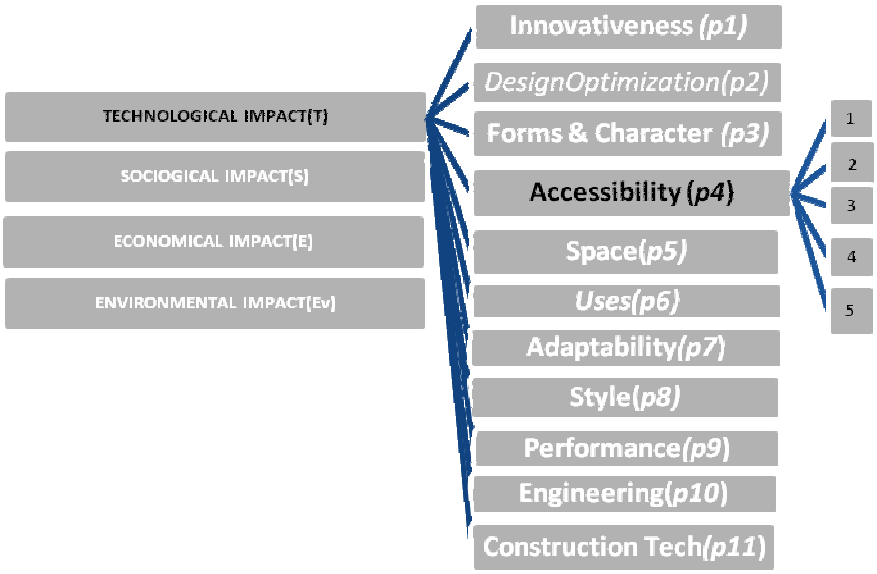

Figure 7.5: Accessiblity

Criteria

1) Consideration for creating architectural 'sense of entry' using additional volumes, void, canopies, threshold detailing, paving etc.

2) Consideration for establishing accessible path of travel from entry to the affordable housing scheme to the dwelling units as well as other supporting facilities.

3) Consideration for locating parking space at a minimal walking distance of (2m-10m) to the dwelling units.

4) Consideration for locating handicapped and elderly parking with immediate access of less than 5m to respective units

5) Consideration for avoiding remote parking.

6) Consideration for providing disabled and/or wheelchair access to spaces within affordable housing scheme.

7) Consideration for locating visitors drop off and parking within 15m to the main entrance with conspicuous mark of ‘‘all visitor parking space’’.

7.2.5 Space (P 5)

This is the capacity of affordable housing scheme to establish good link between indoor and outdoor spaces and also distribute the available space to the adequacy of intended purpose. As a result the affordable housing being assessed is expected to satisfy any or all of the following criteria:

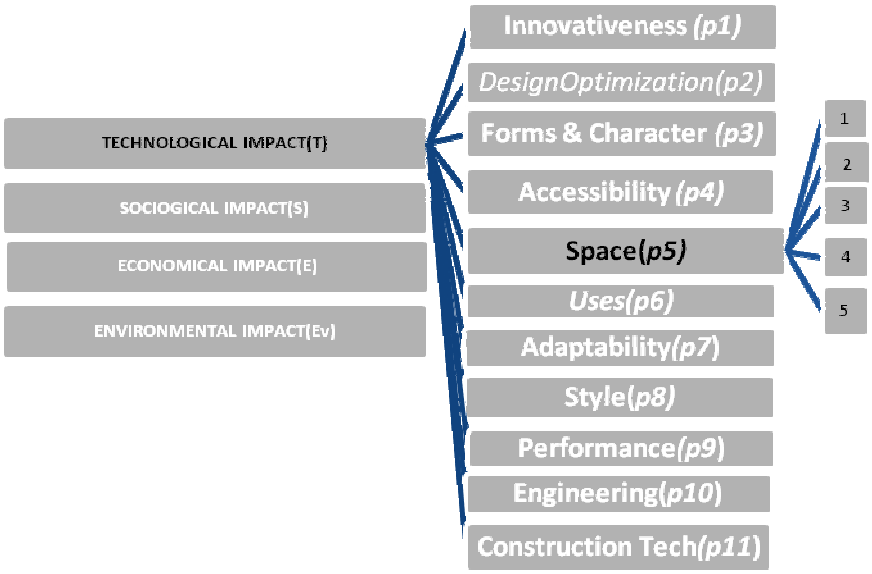

Figure 7.6: Space

Criteria:

1) Consideration for providing clear boundaries between publicly controlled spaces (streets), community controlled spaces (shared open spaces) and privately controlled spaces like patio, porch, deck and balcony within dwelling units.
2) Consideration for either fully or partially enclosing open spaces with buildings to provide clear boundaries.
3) Consideration for linking open spaces so that they form an uninterrupted network of vehicle-free areas.
4) Consideration for provision of minimum space standard for 1 bed 2 person flat as 46sq.m; 2 bed 3-4 person bungalow as 56sq.m; 2 bed 3-4 person bungalow as 66sq.m; 2 bed 4 person house as 73sq.m; 3 bed 5 person house as 86sq.m and 4 bed 7-8 person house as 110sq.m.

7.2.6 Uses (P 6)

This is the extent to which the purpose for every facility in any affordable housing scheme is satisfied through design without undue interference to the other housing facilities. The criteria to be satisfied under this parameter are as follows:

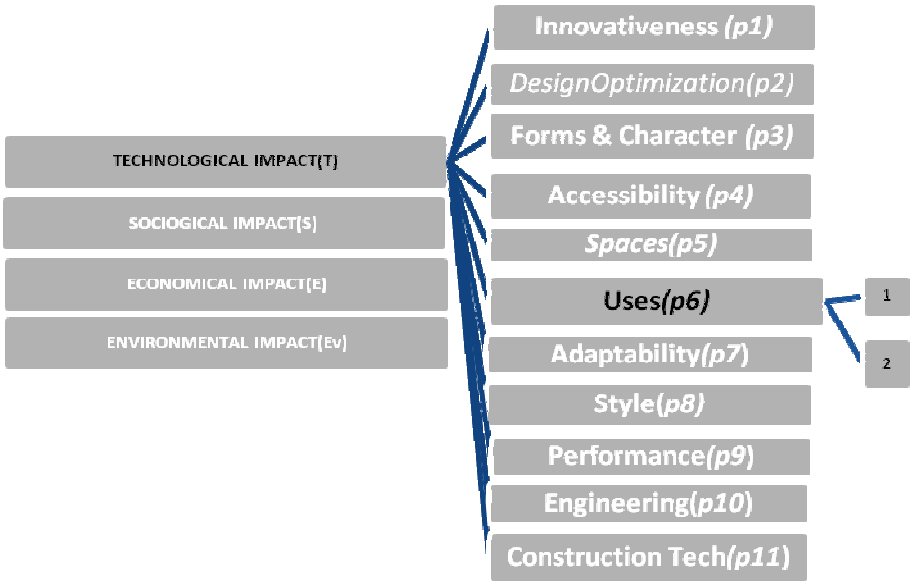

Figure 7.7: Uses

Criteria:

1) Consideration for mixed-use development to also include other units of development (e.g. commercial, industrial, academic, vocational etc) in the proportion of 80% Dwelling units to 20% for others units.

2) Consideration for minimizing use and length of double-loaded corridors.

7.2.7 Adaptability (P7)

This is the capacity for affordable housing to respond to the changing structural, social, environmental, economical and technological needs. The criteria under this parameter are:

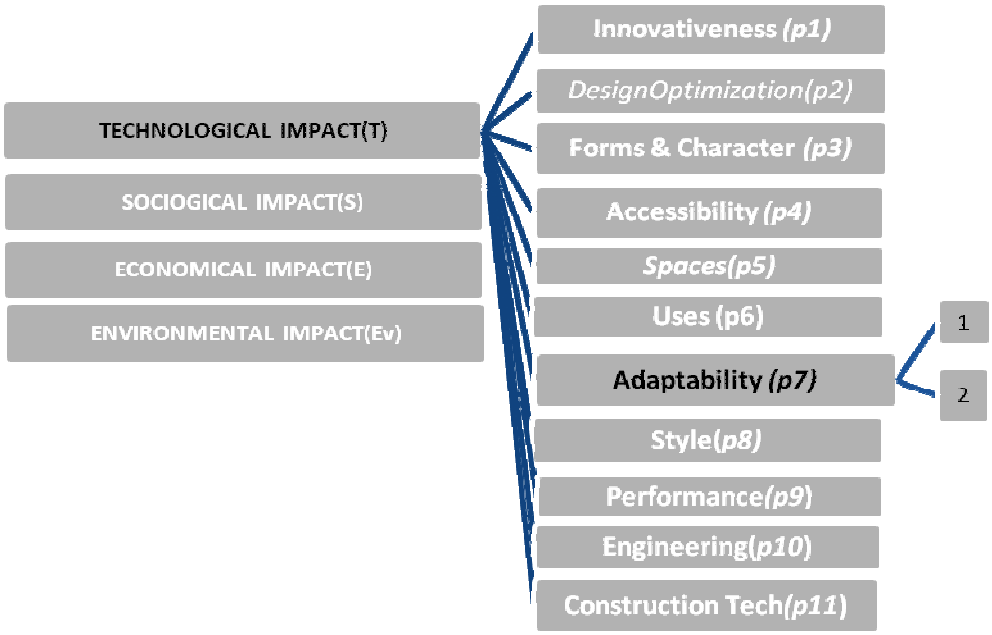

Figure 7.8: Adaptability

Criteria

1) Consideration for the functions of the rooms and other living spaces to be easily convertible without resulting into unwarranted negative impacts.

2) Consideration for upward, downward and sideways extension to be easily achieved from the present state.

7.2.8 Style (P8)

Style is the capacity of affordable housing scheme to be associated with minimum of 60% of the prevailing style(s) within 200m radius of its neighbourhood which may include among the following criteria:

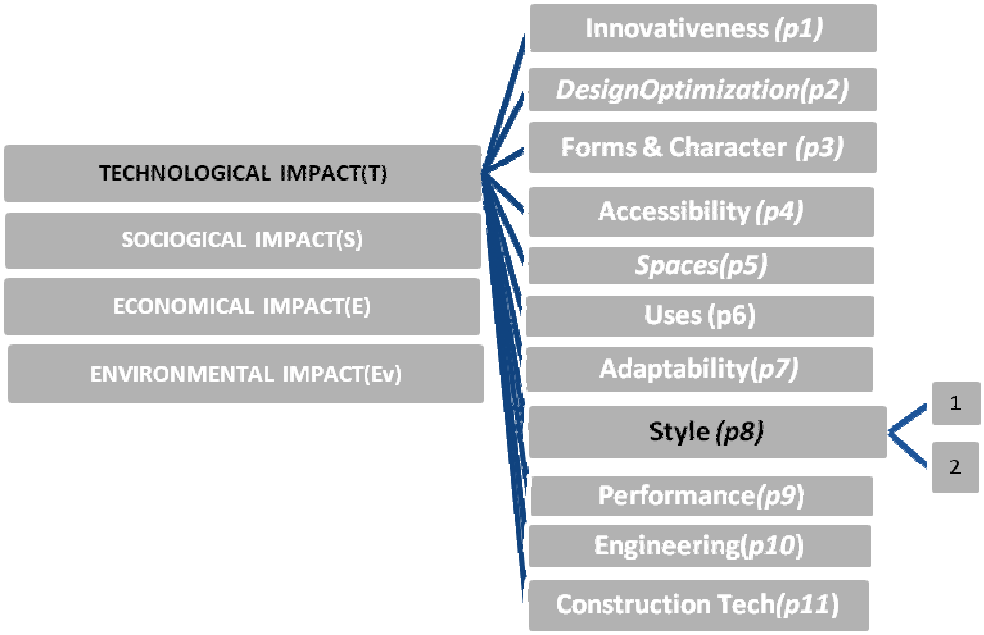

Figure 7.9: Style

Criteria:

1) Consideration for adopting traces of Victorian, Georgian, Carolingian, Regency, Jacobean, modernism styles etc.

2) Consideration for adopting any other style that could easily blend with the style(s) prevailing within 200m radius of the scheme's neighbourhood.

7.2.9 Parameter 9 (Performance)

Performance is the capacity of affordable housing to last for a minimum of 6 months devoid of defects which may arise from either tangible or intangible impacts. These defects may be observed by end-users or assessors under the following:

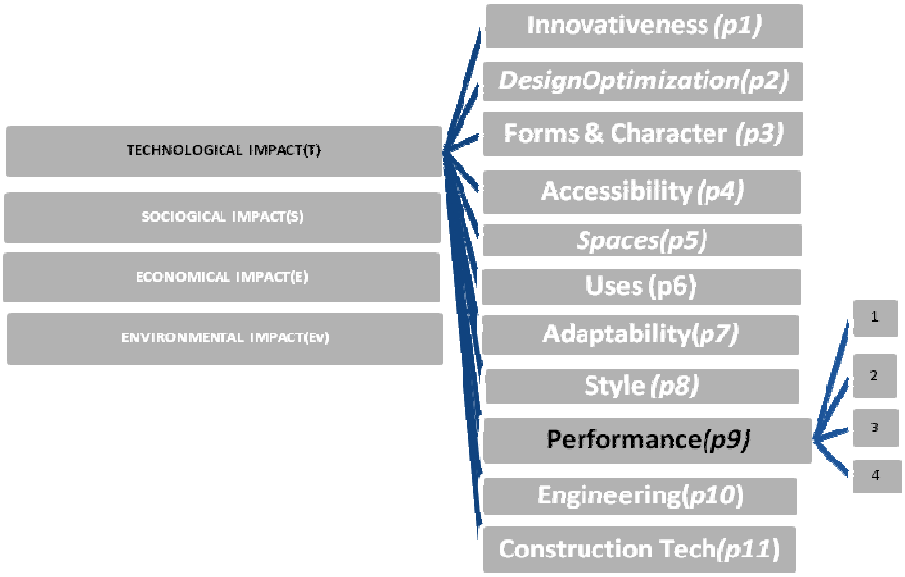

Figure 7.10: Performance

Criteria

1) Consideration for the structural members of affordable housing scheme and the adjoining environment to be made good and functioning to full capacity.

2) Considerations for the general plumbing of affordable housing scheme and the adjoining environment to be made good and functioning to full capacity.

3) Considerations for the electrical fittings of affordable housing scheme and the adjoining environment to be made good and functioning to full capacity.

4) Considerations for the Ironmongery of affordable housing scheme and the adjoining environment made to be made good and functioning to full capacity.

7.2.10 Engineering (P10)

This is the capacity for affordable housing scheme to have its structural framework and engineering services stable and made good. Therefore, affordable housing schemes are assessed based on the following:

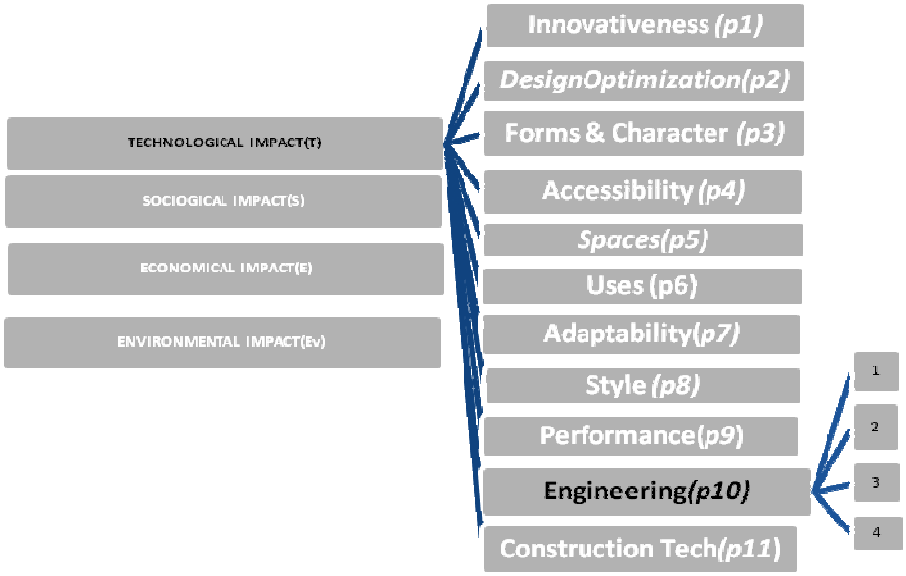

Figure 7.11: Engineering

Criteria

1) Consideration for avoiding engineering appliances that require frequent maintenance.
2) Considerations for locating key support/service areas such as maintenance rooms; mechanical equipment rooms; and trash collection areas.
3) Consideration should be made to provide washing/dryer hook-ups, especially for families and disabled households.
4) Consideration should be made for adequate duct/chase space for both vertical and horizontal duct runs, especially for extractor hood and bathroom fan.

7.2.11 Construction Technique (P11)

This is the capacity to which various modern methods of construction (MMC) techniques were applied to reduce cost; construction period and achieve increased quality input to affordable housing scheme under the following:

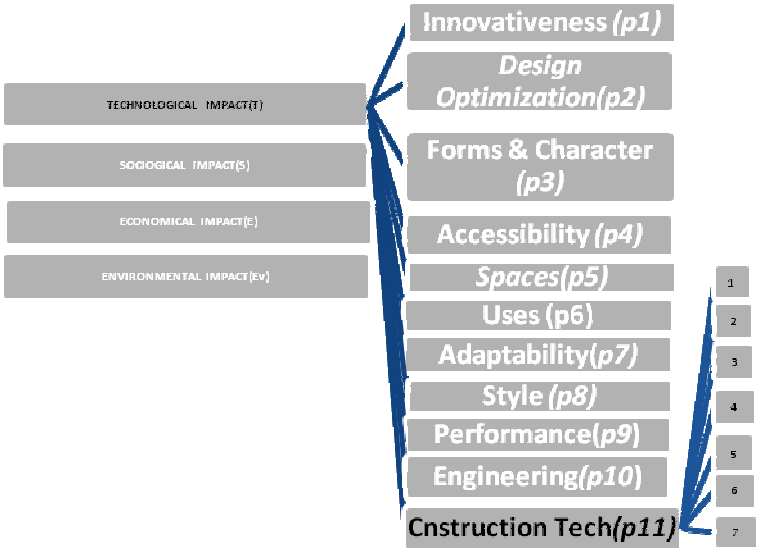

Figure 7.12: Construction Technique

Criteria

1) Consideration for choosing construction technique that can easily be maintained by Do-it-yourself (DIY).

2) Consideration for adopting **volumetric** system of construction technique for affordable housing scheme.

3) Consideration for adopting **panellised** system of construction technique for affordable housing scheme.

4) Consideration for adopting **Pod** system of construction technique for affordable housing scheme.

5) Consideration for adopting **lightweight** system of construction technique for affordable housing scheme.

6) Consideration for adopting **hybrid** system of construction technique for affordable housing scheme.

7) Consideration for adopting **sub-assembly and components** system of construction technique for affordable housing scheme.

7.3 PARAMETERS OF SOCIOLOGICAL IMACT FACTORS

This is the capacity of affordable housing scheme to create a sense of place and have positive effect on the local community and environment as shown in the following parameters and their criteria.

7.3.1 Social Inclusiveness (P12)

This is the extent to which any affordable housing scheme fosters access to job, school, healthcare, food, social, sporting and cultural facilities for a variety of users, residents and stakeholders irrespective of sex, ethnicity, race, religion or social disposition in the following.

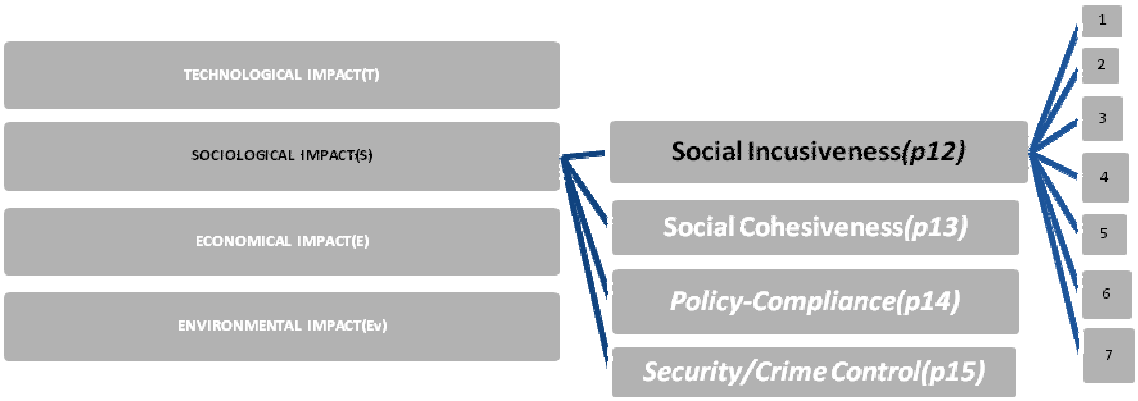

Figure 7.13: Social Inclusiveness

Criteria

1) Consideration for locating handicapped and elderly parking with immediate access of less than 5m to respective dwelling units.

2) Consideration for mix-use dwellings involving high, middle and low income earners in the proportion 10-15%,20-30%,40-55% respectively.

3) Consideration for access to job for inhabitants within 2000m radius of the dwelling units.

4) Consideration for access to primary/secondary school for inhabitant within 2000m radius of the dwelling units.

5) Consideration for access to healthcare facility for inhabitant within 2000m radius of the dwelling units.

6) Consideration for access to shopping facilities for inhabitants within 500m radius of the dwelling units.

7) Consideration for access to social-cultural or sporting facilities for inhabitant within 1200m radius of the dwelling units.

7.3.2 Social Cohesiveness (P13)

This is the capacity for the scheme to exploit indoor, outdoor spaces and facilities for integration of various ethnic, racial, religious, gender and social differences existing among the inhabitants for the common goal of the entire community in the following:

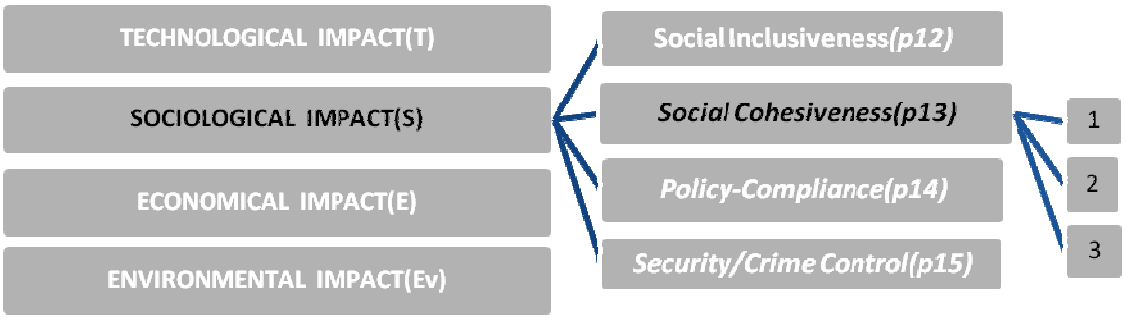

Figure 7.14: Social Cohesiveness

Criteria

1) Consideration for the use of outdoor open spaces and facilities to integrate different groups of affordable housing inhabitants.

2) Consideration for the use of indoor spaces and facilities to integrate different groups of affordable housing inhabitants.

3) Consideration for fair and equitable distribution of public services and facilities to different groups of inhabitants within affordable housing scheme.

7.3.3 Policy compliance (P14)

This is the capacity of compliance to planning policy guidelines, codes and bye-laws in developing an affordable housing scheme. Therefore, affordable housing schemes assessed under this parameter are expected to fulfil part or all the following:

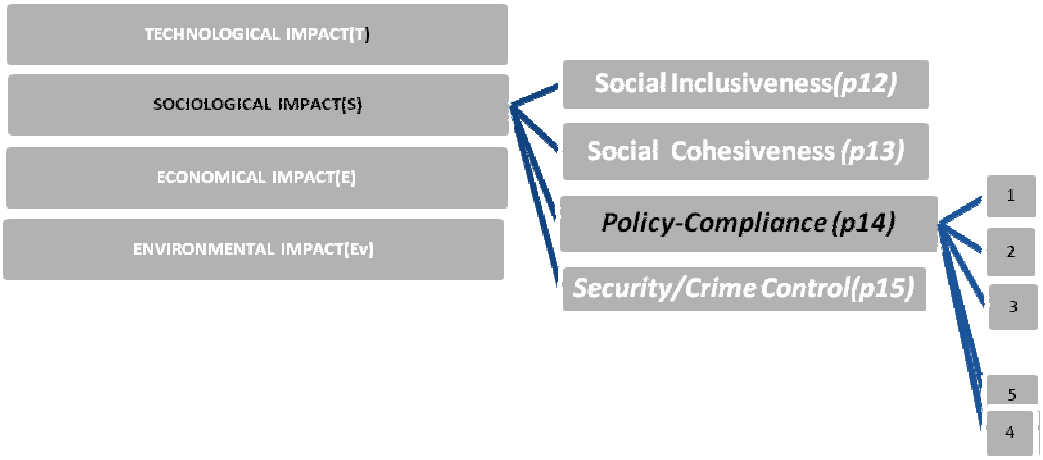

Figure 7.15: Policy Compliance

Criteria

1) Consideration for complying with (PPS1) in fostering good designs that contribute positively to making places better for people, while rejecting designs that fail to take the opportunities available for improving the character and quality of an area.

2) Consideration for complying with (PPS3) in ensuring the provision of well-designed new homes, further establishing the government's commitment to good design.

3) Consideration for application of code for 'sustainable homes' in designing and constructing of affordable housing.

4) Consideration for application of codes for 'Build for Life' in designing and constructing affordable housing.

7.3.4 Security/Crime Control (P15)

This is the capacity for affordable housing scheme to foster security of the inhabitants, their properties and also control crime within its neighbourhood. The affordable housing being assessed is expected to satisfy any or all of the following criteria:

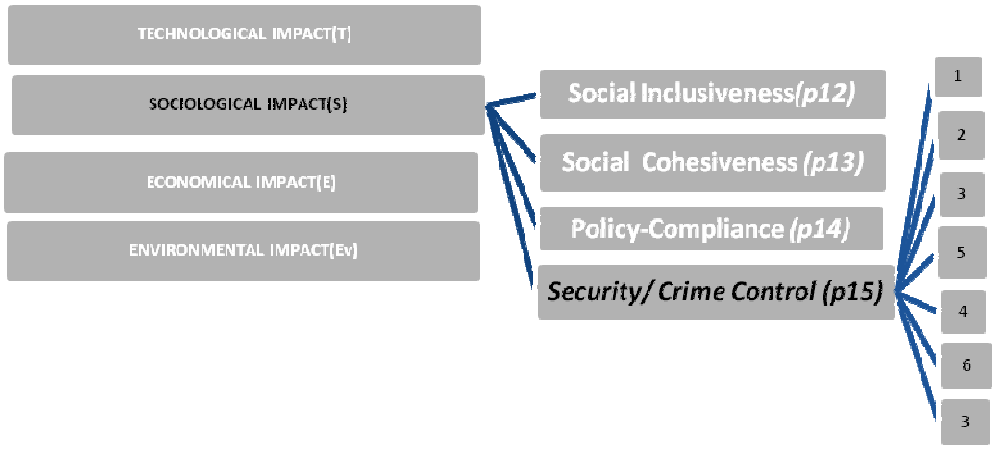

Figure 7.16: Security /Crime Control

Criteria

1) Consideration for locating parking space at such a place that allows for casual surveillance of cars from a number of different units.

2) Consideration for provision of access to shared open spaces from individual units, preferable from the kitchen, living room or dining room.

3) Consideration for properly lighting the parking space with lights that are energy efficient and doesn't cause glare or otherwise have negative impact on the surrounding buildings.

4) Consideration for night time lighting plan over shared open spaces should be such that it provides light from variety of sources and match lighting intensity and quality to the use for which it is intended e.g. parking garage or pedestrian path.

7.4 PARAMETERS OF ECONOMIC IMPACT FACTORS

Economical Impact refers to the ability of affordable housing to create a sense of place and have positive effect on the local community and environment in the following areas of this research:

7.4.1 Job Creation (P16)

This is the capacity for any affordable housing scheme to provide opportunity for meaningful employment of the inhabitants through design, location and/or planning of the scheme. Therefore, affordable housing schemes are expected in this parameter to achieve some or all of the following criteria.

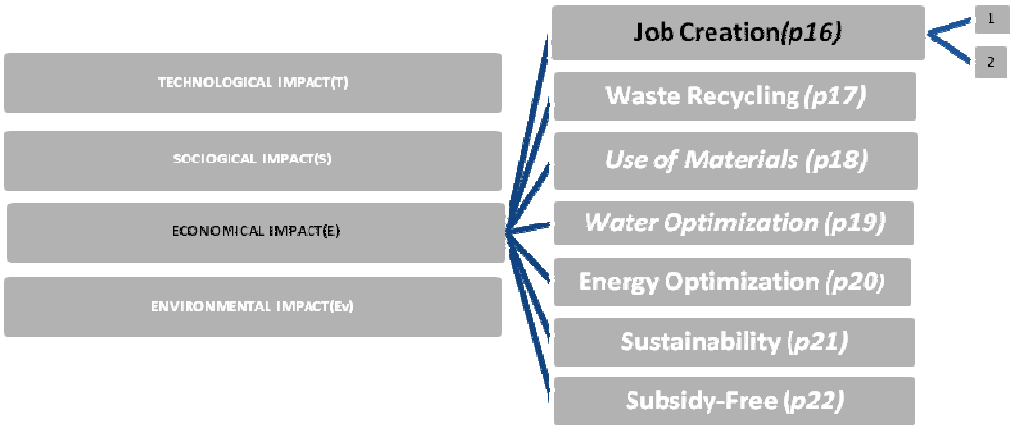

Figure 7.17: Job Creation

Criteria

1) Considerations are for the scheme to include spaces for vocational training.

2) Consideration for including office space(s) in some dwelling units.

7.4.2 *Waste Recycling (P17)*

This is the capacity for any affordable housing scheme to recycle waste generated within the scheme for economic benefit of the inhabitants and reduction of overall cost.

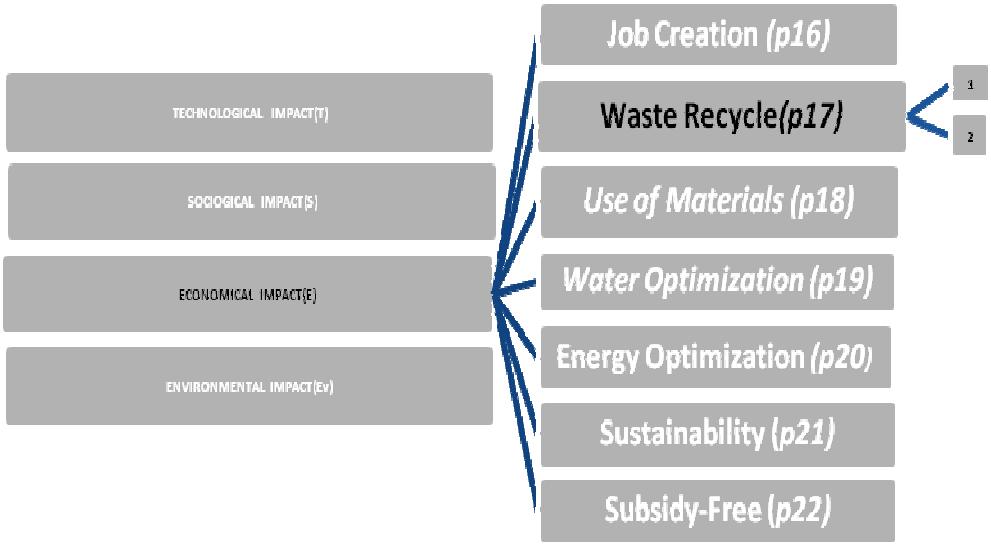

Figure 7.18: Waste Recycle

Criteria

1) Consideration is for provision of an efficient system for recycling about 40-60% of liquid waste within the scheme.

2) Consideration is for tying the waste recycling system to economic viability and sustainability of affordable housing scheme.

7.4.3 *Use of Materials (P18)*

This is the capacity of affordable housing scheme to achieve cost reduction without compromising quality in the specification of the building materials for its construction. In this category affordable housing schemes being assessed is expected to satisfy any or all of the following criteria.

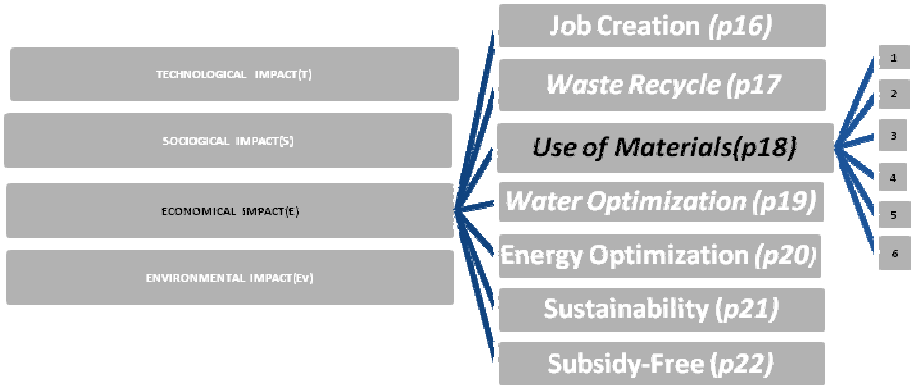

Figure 7.19: Use of Material

Criteria

1) Consideration for selecting materials for façade (including foundation walls and roofing) should be such that it is compatible with not less than 50% of good quality buildings in the neighbourhood.

2) Consideration should favour the use of materials that don't require repeated or expensive maintenance.

3) Consideration should favour using materials with high levels of recycled content

4) Consideration should favour materials that the inhabitants can easily maintain themselves using Do-It-Yourself (DIY) technique.

5) Consideration should favour resilient flooring materials in kitchens, bathrooms, laundries, dining rooms and entrances.

6) Consideration should favour use of healthy building materials for interior finishes and materials, such as carpet, resilient flooring, paint, glues, and cabinets.

7.4.4 Water Optimization (P19)

This is the capacity for minimizing the quantity of water usage or increased efficiency in water us or re-uses within affordable housing scheme.

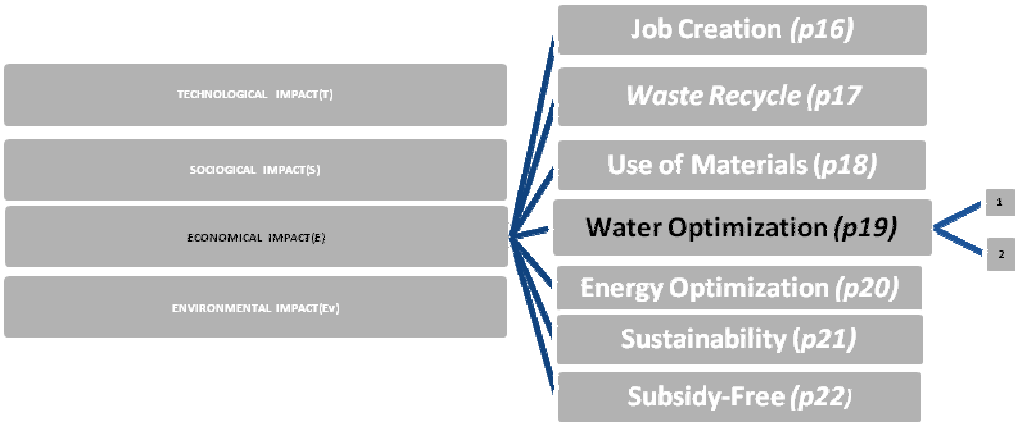

Figure 7.20: Water Optimization

Criteria

1) Consideration should be for the exploitation of cheap or free water supply sources through rain, spring, borehole, rivers etc.
2) Consideration should be focused on adopting cheap and efficient means/techniques for water use or re-use.

7.4.5 Parameter 20 (Energy Optimization)

This is the capacity for affordable housing scheme to reduce the cost of energy being used by the inhabitants. However, the affordable housing being assessed is expected to satisfy any or all of the following criteria:

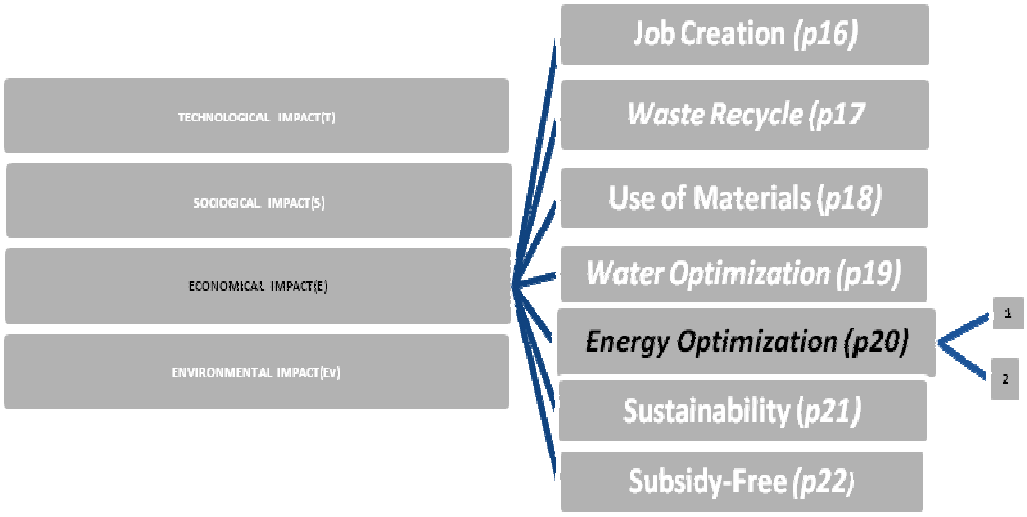

Figure 7.21: Energy Optimization

Criteria

1) Consideration should be made to provide heavy-duty, energy-efficient appliances and fixtures.

2) Consideration should be for the use of alternative and cheaper sources of energy supply like solar, fossil and wind power.

7.4.6 Sustainability (P21)

This is the capacity of affordable housing scheme to meet with the needs of the present inhabitants without compromising the ability of future inhabitants from meeting their own needs at a considerably low cost.

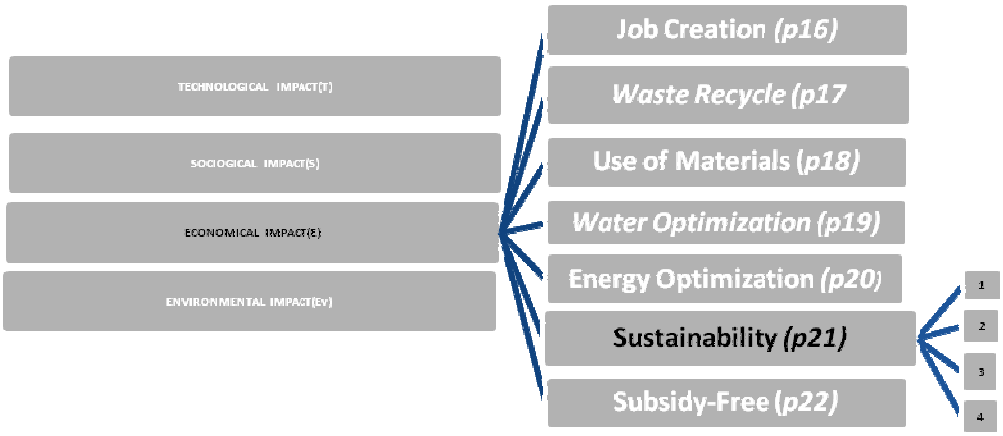

Figure 7.22: Sustainability

Criteria

1) Consideration should be for the use of materials and systems that have the capacity to continually support ecosystem and the inhabitants while creating a safe and affordable environment

2) Consideration for provision of sustainable scheme using cheap or free sources of energy, water, waste, and agricultural products.

3) Consideration for the use of not less than 60% bio-degradable building materials for construction of affordable housing schemes.

4) Consideration for provision lot (garden) spaces for sustainable agriculture.

7.4.7 Subsidy-free (P22)

This is the capacity of affordable housing scheme to reduce or totally abstain from financial subsidy from public funds while still remaining cost effective.

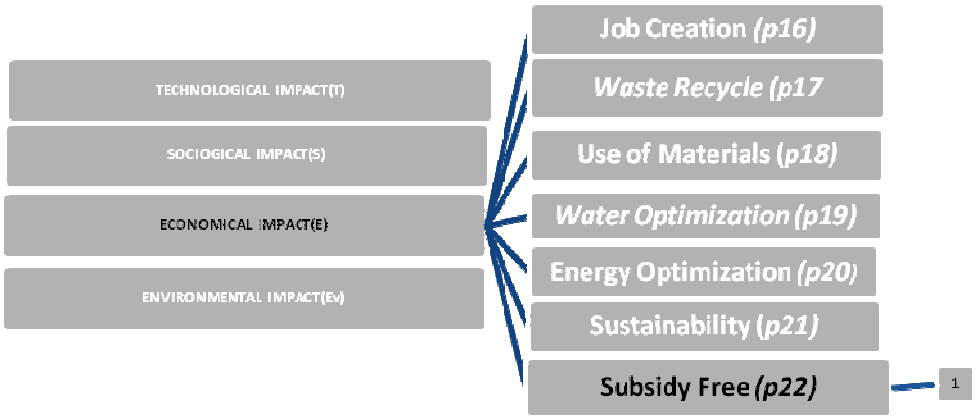

Figure 7.23: Subsidy-free

Criteria

1) Consideration for the subsidy of the schemes should be such that it covers not more than 20% of the value of the scheme.

7.5 PARAMETERS OF ENVIRONMENTAL IMPACT FACTORS

Environmental Impact refers to the ability of affordable housing scheme to create a sense of place and have positive effect on the local community and environment in the following areas of this research.

7.5.1 Zoning (P23)

This is the capacity of locating affordable housing scheme in such a place as to achieve the following considerations to the benefit of the inhabitants:

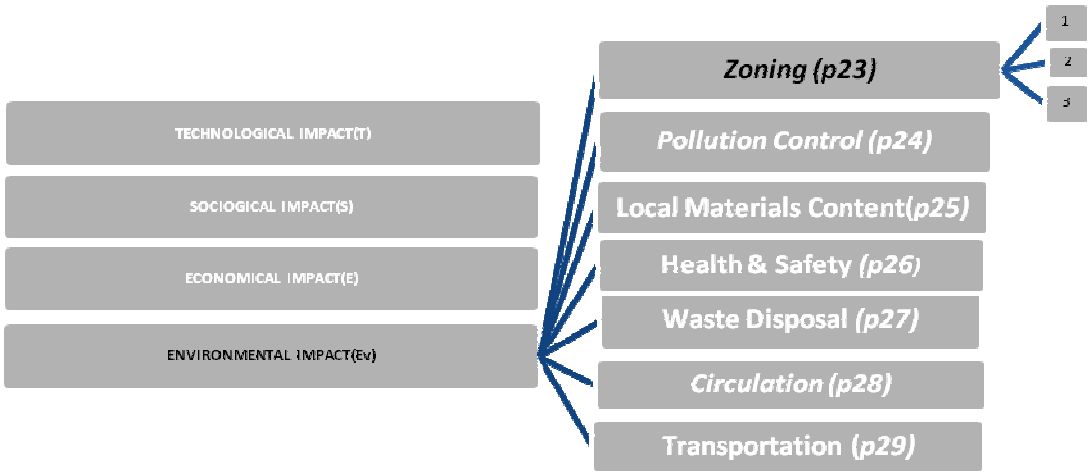

Figure 7.24: Zoning

Criteria

1) Consideration for integrating affordable housing scheme to the greater urban growth.
2) Consideration for location of scheme to easy links with transportation networks.
3) Consideration for location of affordable housing to foster security of lives and properties.

7.5.2 Pollution Control (P24)

This is the capacity of affordable housing scheme to provide means for the control of both existing and anticipated pollutants within its neighbourhood.

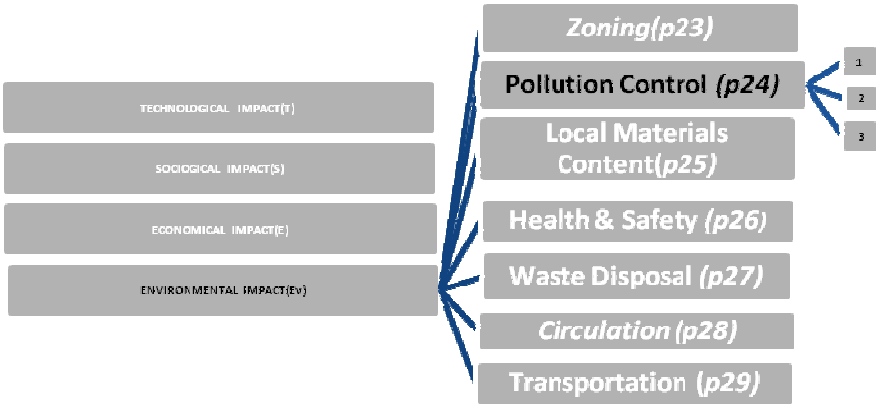

Figure 7.25: Pollution Control

Criteria

1) Consideration for use of building materials which are environmentally safe.

2) Consideration for providing carbon reduction technique/system within affordable housing scheme.

3) Consideration for provision of pollution control systems like air purifier.

7.5.3 Local Materials Contents (P25)

This is the capacity of using local building materials in the construction of affordable housing scheme.

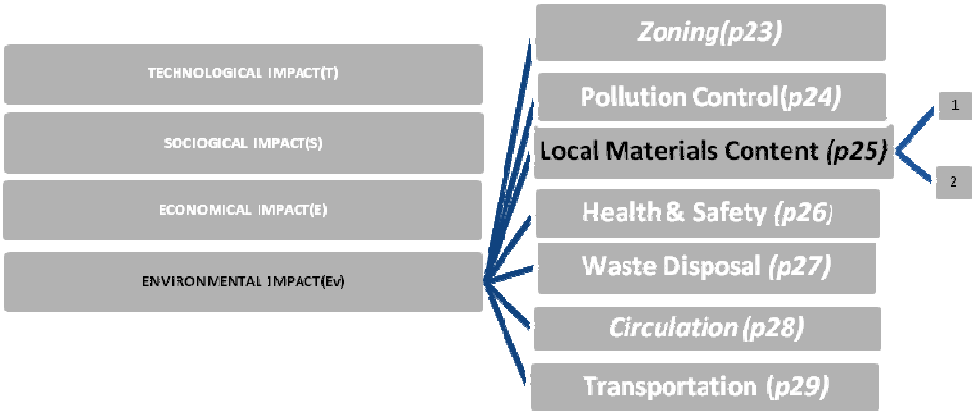

Figure 7.26: Local Material Content

Criteria

1) Consideration should be such as to involve 50-100% use of local materials found within 5km radius in building affordable housing to save cost usually lost in transportation.

2) Consideration should be such as to greatly reduce the use of pre-processed materials from 40%- 0% in building affordable housing to save the environment.

7.5.4 Health and Safety (P26)

This is the capacity of affordable housing scheme to maintain good and adequate healthy and safety environment for the inhabitants.

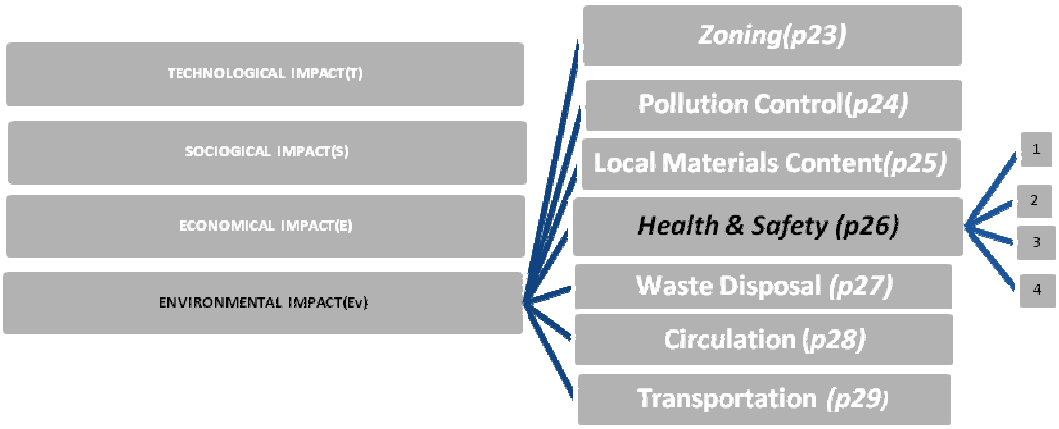

Figure 7.27: Health and Safety

Criteria

1) Consideration for provision of fire alarms, exits, water hose, fire extinguishers and sprinklers at convenient locations and intervals.
2) Consideration for flood control techniques in affordable housing scheme.
3) Consideration for location of the scheme away from exposure to materials or chemicals that could be hazardous or injurious to the inhabitants of the scheme.
4) Consideration for the use of construction materials that are predispose to causing harm or deaths to the inhabitants.

7.5.5 Waste Disposal (P27)

This is the capacity for proper disposition of unwanted waste from any affordable housing schemes.

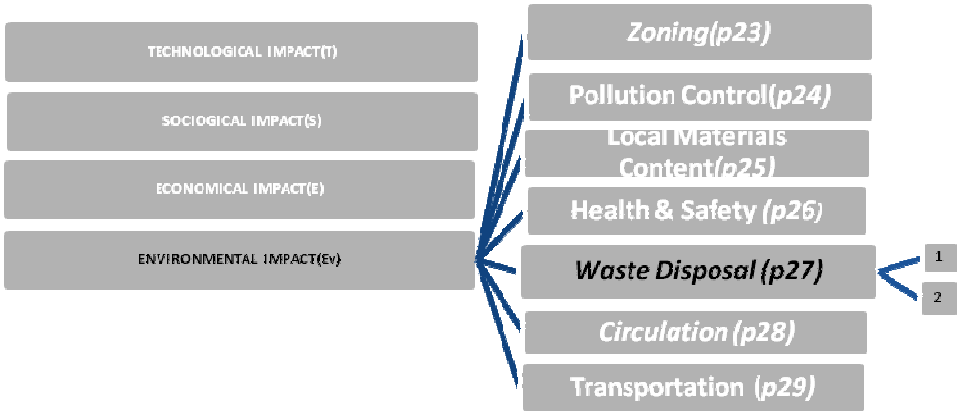

Figure 7.28: Waste Disposal

Criteria:

1) Consideration should be made for the path of travel for trash from source to removal area.
2) Consideration should be made to provide screened trash collection areas that are convenient and easy to access from all units.

7.5.6 Circulation[Road; Pedestrianization;Parking] (P28)

This is the capacity for affordable housing scheme to establish strong links between various parts of the scheme through road networks; adjoining pedestrian walkway and parking space(s). However, the affordable housing being assessed under this parameter is expected to satisfy any or all of the following:

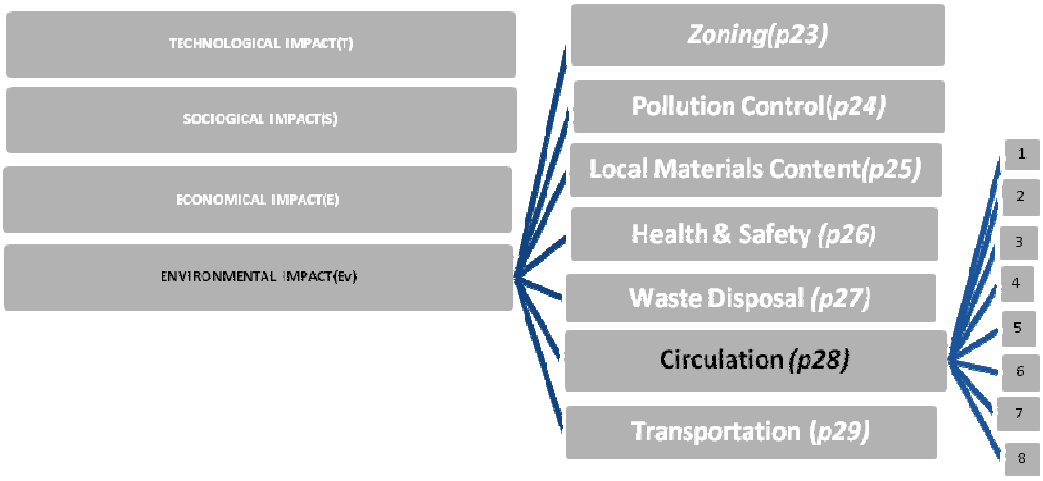

Figure 7.29: Ciculation

Criteria

1) Consideration for locating garages, driveways and parking lots to the rare or side of the building being assessed.

2) Considerations for letting majority of other dwelling units of the assessed building face the street instead.

3) Consideration for planting shrubs and trees to soften the overall impact of the parking areas and provide shade and noise reduction.

4) Consideration for locating support facilities like pub, health centre, bus stop, post box, local shop, crèche, community centre and Local Park within 400m or 5 minutes walk from dwelling units.

5) Consideration for locating library, local rail station, school, park and leisure within 800m or 10 minutes walk from dwelling units.

6) Consideration for locating individual parking space at a minimal walking distance of between (2m-10m) from the dwelling units.

7) Consideration for minimizing conflict between vehicles and pedestrians.

8) Consideration for separating bicycle and pedestrian paths from vehicular traffic.

7.5.7 Transportation (P29)

This is the capacity of affordable housing scheme establishing strong, efficient and cheap commune links between itself and the rest of the world through road/rail networks and waterways. However, affordable housing being assessed under this parameter is expected to satisfy any or all of the following

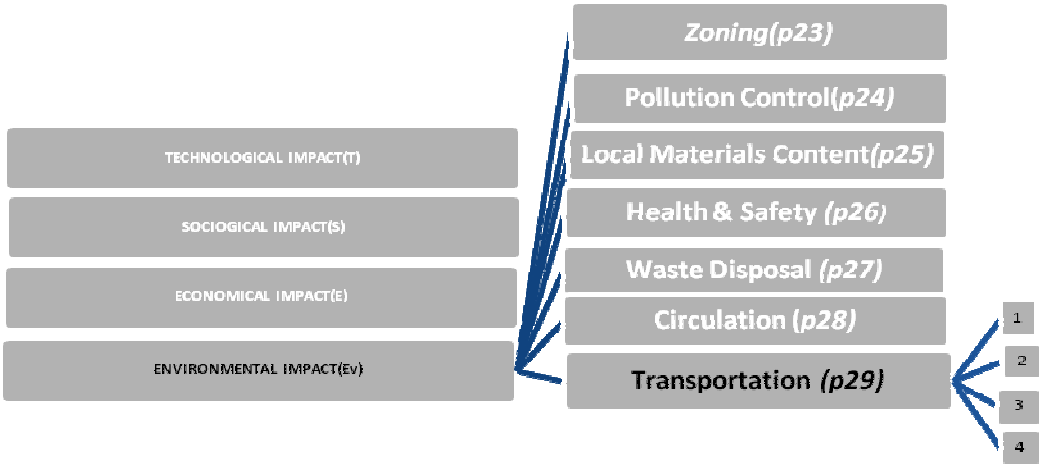

Figure 7.30: Transportation

Criteria:

1) Consideration for location of the scheme within minimum of 20 minutes walk from the nearest bus station
2) Consideration for location of the scheme within minimum of 20 minutes walks from the nearest train station.
3) Consideration for location of the scheme within minimum of 20 minutes walks from the nearest boat station.
4) Consideration for design of the scheme to provide for Bicycle Park.

7.5 CHAPTER SUMMARY

The chapter presented the framework for the conceptual quality toolkit. The framework comprises of the 4 impact factors, 29 parameters and 114 criteria in all. The number of criteria in any parameter is expandable. The criteria were presented under their parameters, while the parameters were presented under their impact factors in an orderly manner. The respective diagrams shown in the chapter present clusters of criteria looped together to their parent parameters, which in turn are grouped under relevant impact factors. The comprehensive toolkit is indicated in Appendix 5.

CHAPTER 8

8.0 DEVELOPMENT OF AFFORDABLE HOUSING QUALITY BENCHMARK

8.1 INTRODUCTION

The design for a benchmark model in this research has both empirical and theoretical perspectives. The empirical model perspective was derived from integrated data arising from (Questionnaire) quantitative data and case studies (qualitative data). Hence, it embraces a fundamental analysis using the data from both questionnaire and qualitative case study in the model construct. The analytical concept adopted was exploratory in nature. The analysis was derived from interpretation of site situation that depicts the level of function and design quality inherent in UK affordable Housing projects. This interpretation clearly shows site situation with regards to space distribution; space relationship; material application etc. Subsequently, the Key Performance Indicators (KPIs) were fundamentally conceived from data from questionnaire which was further developed using parameters from UK quality standards into quality model. Hence, the questionnaire was developed based on the structure of these (KPIs).

The (KPIs) are located at the centre of the questionnaire data analysis. They were also developed into impact factors used as measuring scale in this research. These KPI's are: Design, Build, Socio-economical, Innovative, Cost-savings and Environmental, Quality Indicators. Each indicator has its (goal and objectives) as its primary target with 'indicative outcomes' as evidence showing that the set targets were achieved. While the goals and objectives were further derived from quality

standards through comparative analysis, the data obtained from the Questionnaire survey and analyzed, shows the level of outcome.

This chapter therefore presents the combination of the outcome arising from questionnaire response data analysis with the interpretation of the architectural site situation of (case study) on affordable housing schemes.

8.2 CONCEPTUAL DEVELOPMENT

The figure 8.1 below shows 'the impact assessment framework for affordable housing quality'. This framework was developed from aggregate of groupings of impact criteria under categories of Key Performance Indicators (KPI). The resultant KPIs or quality dimensions as derived from questionnaire are Design Quality Indicator (D*q*I); Building Quality (B*q*I); Cost Saving Quality (C*q*I); Innovative Quality (IqI); Socio-Economical Quality (S*q*I); and Environmental Quality (E*q*I). These KPIs were basically used in this research as part of assessment toolkit to determine if the outcome or objectives of the research are achieved and also to validation the resultant benchmark model.

Questionnaire data was highly significant in deriving this concept which originated from the six fundamental indicators adopted at that stage of the research.

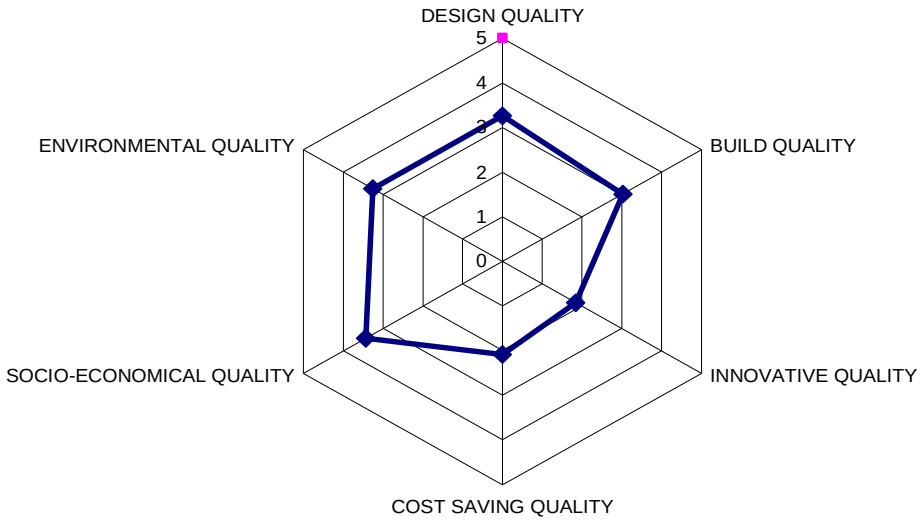

Figure 8.1: Stage II of conceptual AHQB model

8.3 DEVELOPMENT OF AFFORDABLE HOUSING QUALITY BENCHMARK MODEL

The proposed model was designed to capture and represent the quality dimensions being modelled as closely as is practical. It must also include the essential features of the quality whilst being reasonably cheap to construct and operate and easy to use. This was effectively carried out through the use of resource base and knowledge earlier acquired from literature review; theoretical framework; case study and survey.

Figure 8.2 illustrates developmental process for AHQB model. There are 16 sequential stages of developmental stages for this model. These stages are closely linked to each other and sometimes simultaneously implemented. The sequence of these stages are indicated as follows::

1) Determine Samples of affordable housing

2) Design and Develop General Questionnaire survey

3) Conduct of General Survey

4) Analysis of Data collated from the General Survey

5) Determine achieved Levels of Impact factors from questionnaire (using QII)

6) Conduct Sample case studies

7) Determination of the coding for the impact factors

8) Transcribe Texts and Visuals into Numerical Values

9) Determine best quality value achieved through comparison of the case samples

10) Determine best group of quality

11) Present Overall Results (Benchmark)

12) Develop affordable housing quality toolkit

13) Use developed toolkit to collect implementation data

14) Analyse implementation data

15) Determine values achieved for implementation schemes

16) Benchmark the result got in 15 against established values in 11 for validation

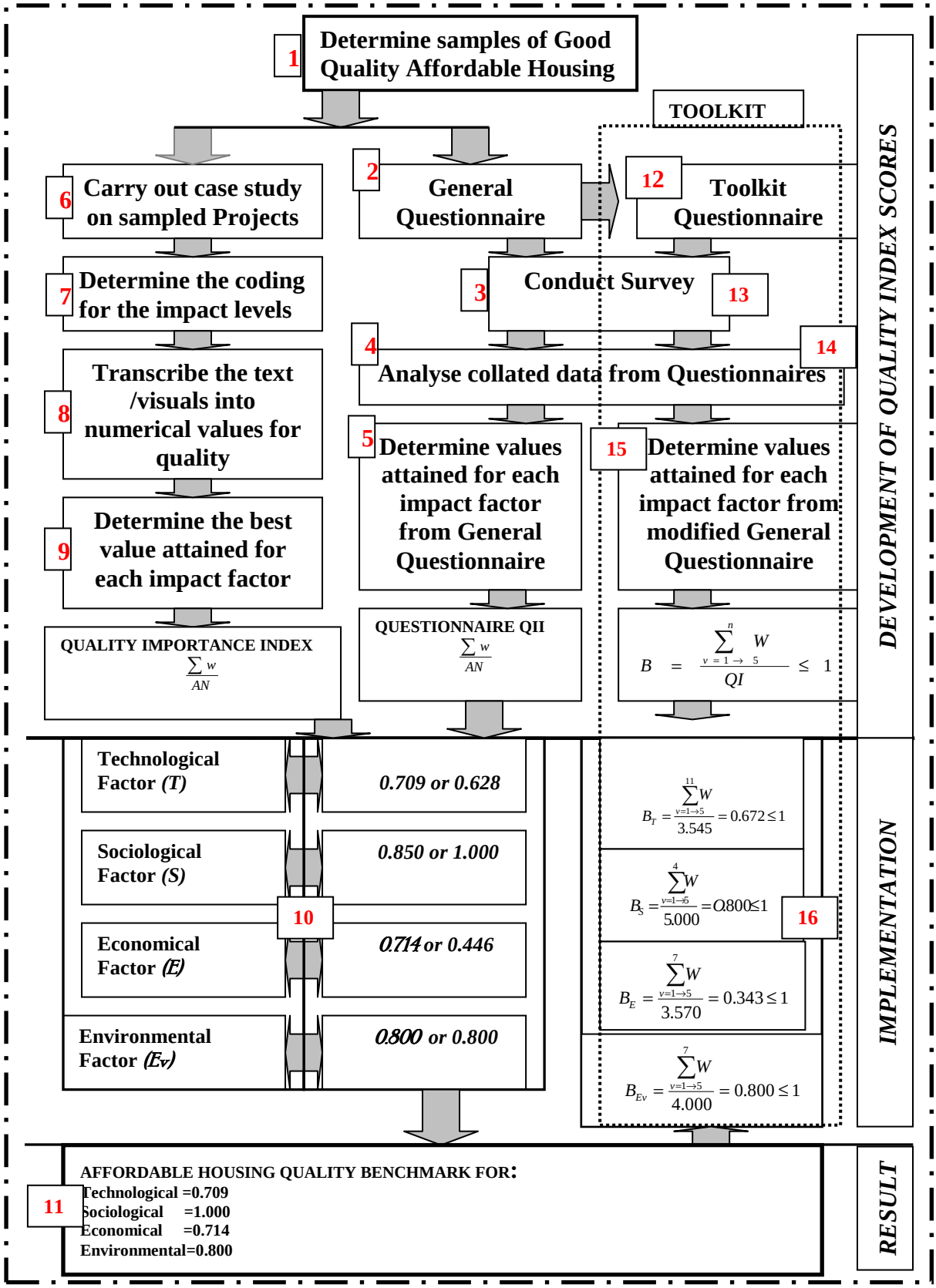

Figure 8.2: AHQB Model Developmental Process

Nevertheless, the components of this model are the impact factors which have 'inter alia' been determined in this research.

Therefore let:

Tq= Technological impact recorded on the sampled projects (output)

Eq= Economical impact recorded on the sampled projects (output)

Sq= Sociological impact recorded on the sampled projects (output)

Evq= Environmental impact recorded on the sampled projects (output)

C.S.= Case Study (1.1;1.2;2.1;2.2;3.1;3.2;4.1;4.2;5.1;5.2)

and.....

Tcs= Technological impact arising from Case Studies

Ecs= Economical impact arising from Case Studies

Scs= Sociological impact arising from Case Studies

Evcs= Environmental impact arising from Case Studies

DqI= Design Quality Indicator arising from Questionnaire

BqI= Build Quality Indicator arising from Questionnaire

IqI= Innovative Quality Indicator arising from Questionnaire

CqI= Cost Control Quality Indicator arising from Questionnaire

SqI= Socio-economic Quality arising from Questionnaire

EqI= Environmental Quality Indicator arising from Questionnaire

The matrix below indicates the comparison within each quality standard in bracket for two case study schemes considered under each of all the five quality standards.

The output is usually the best scheme (max) in each case below in the computation.

Hence if:

Tcs*= [(C.S.1.1*1.2)(C.S 2.1*2.2)(C.S.3.1*3.2)(C.S.4.1*4.2)(C.S.5.1*5.2)]*

Ecs*= [(C.S.1.1*1.2)(C.S 2.1*2.2)(C.S.3.1*3.2)(C.S.4.1*4.2)(C.S.5.1*5.2)]*

Scs*= [(C.S.1.1*1.2)(C.S 2.1*2.2)(C.S.3.1*3.2)(C.S.4.1*4.2)(C.S.5.1*5.2)]*

Evcs*= [(C.S.1.1*1.2)(C.S 2.1*2.2)(C.S.3.1*3.2)(C.S.4.1*4.2)(C.S.5.1*5.2)]*

And…….

Tq*= [(DqI)(BqI)(IqI)(CqI)(SqI)(EqI)]*

Eq*= [(DqI)(BqI)(IqI)(CqI)(SqI)(EqI)]*

Sq*= [(DqI)(BqI)(IqI)(CqI)(SqI)(EqI)]*

Evq*= [(DqI)(BqI)(IqI)(CqI)(SqI)(EqI)]*

Integrating data values from the two sources as indicated in this study (projects' samples and practitioners' questionnaire) will result into an empirical model. Therefore, an empirical model derived from affordable housing quality index and data from Developers' Questionnaires above is as follows:

Project Case Studies Data:

$$Tcs=\text{Max}\left[0.600\|0.672\|0.564\|0.509\|0.709\|0.581\|0.509\|0.655\|0.655\|0.690\right]=\left[0.709\right]$$

$$Scs=\text{Max}\left[0.800\|0.800\|0.850\|0.750\|0.700\|0.800\|0.700\|0.750\|0.600\|0.600\right]=\left[0.850\right]$$

$$Ecs=\text{Max}\left[0.343\|0.343\|0.571\|0.514\|0.400\|0.400\|0.429\|0.543\|0.714\|0.686\right]=\left[0.714\right]$$

$$Evcs=\text{Max}\left[0.714\|0.800\|0.686\|0.629\|0.686\|0.600\|0.514\|0.800\|0.800\|0.743\right]=\left[0.800\right]$$

Questionnaire Data from Developers:

$$Tq=\text{Max}\left[0.628\|0.592\|0.368\|0.320\|0.000\|0.000\right]=\left[0.628\right]$$

$$Sq=\text{Max}\left[1.000\|0.000\|0.000\|0.000\|0.534\|0.614\right]=\left[1.000\right]$$

$$Eq=\text{Max}\left[0.000\|0.200\|0.258\|0.346\|0.446\|0.520\right]=\left[0.520\right]$$

$$Evq=\text{Max}\left[0.760\|0.800\|0.000\|0.000\|0.000\|0.512\right]=\left[0.800\right]$$

The outcome of the data integration above resulted into Reference Quality Benchmark (QI) for the following impact factors: Technological=**0.709**; Sociological=**1.000**; Economical=**0.714** and Environmental=**0.800**.

Calculating for Relative Benchmark Score using $B_I = \frac{I_v}{QI_I}$ (where *I* is any Impact Factor; and the benchmark remains valid if $B_I \leq 1$)

Let….

B_t = Relative Benchmark Value with respect to T (Technological Impact Factor)……(1)

Therefore:

$$\left(B_t\right) = \frac{Total'Weight'Of'\text{Im}\,pact'Factor}{\text{Re}\,ference'Quality'Benchmark} = \frac{T_v}{QI_t} \text{ ……(2)}$$

If…

v = Total Weight Achieved by an Impact Factor

QT = Reference Quality Benchmark with respect to Technological Impact

$B_T; B_S; B_E; B_{EV}$ = Benchmarks for Technological; Sociological; Economical and Environmental Impact Factors respectively

N = Total Number of Parameters in an Impact Factor

W = Any Impact Factor (T; S; E and EV)

Hence, the quality level of any affordable housing could be calculated using the quality level obtain comparative to the benchmark of the impact factors:

$$B = \frac{\sum_{v=1}^{N} W_v}{QI} \leq 1 \quad \text{.....(3)}$$

Using $B_T = \frac{\sum_{v=1}^{11} T_v}{3.545} = \frac{0.709}{3.545} \leq 1$ .....(4)

Social Quality impact Level:

$$B_S = \frac{\sum_{v=1}^{4} S_v}{5.000} = \frac{0.850}{5.000} \leq 1 \quad \text{.....(5)}$$

Economic Quality impact Level:

$$B_E = \frac{\sum_{v=1}^{7} E_v}{3.570} = \frac{0.714}{3.570} \leq 1 \quad \text{.....(6)}$$

Environmental Quality Impact Level:

$$B_{Ev} = \frac{\sum_{v=1}^{7} EV_v}{4.000} = \frac{0.800}{4.000} \leq 1 \quad \text{.....(7)}$$

8.3.1 Categories of Viewpoint

'Good quality affordable housing scheme as well as good quality built environment is a function of good quality design, planning and construction'. However, what that constitutes 'good quality' can only be determined through measurement or assessment. Good quality design does not necessarily transform into good quality built environment, except if the planning and the constructions are also of 'good quality'.

The emerging theory evolved from several strands of work in the built environment and other fields in the past.

8.3.2 Implementation of Affordable Housing Quality Benchmark Model

Let the impact factors be denoted by: *T* (Technological); *S* (Sociological); *E* (Economical); *Ev* (Environmental) and their parameters by: *Tp, Sp, Ep, Evp* respectively and the weighting factor ranges from 1 (lowest impact) to 5 (highest impact). However, the parameters are numbered $p_1; p_2; p_3; p_4 \ldots\ldots p_{29}$ = Parameter 1; Parameter 2….. Parameter29. Therefore, the weighting is determined by the cumulative of the criteria achieved relative to the entire criteria on the toolkit. The numbers of criteria on each parameter are expandable.

Let:

n_{ca}=Number of Criteria Achieved

n_c = Total Number of Criteria in a Specific Parameter

X = Maximum impact weight (5)

N = Aggregate value for all criteria in an Impact Factor

Weighting of a Parameter = $\frac{Number`of`Criteria`Achieved`in`the`Parameter}{Total`Number`of`Criteria`in`the`Parameter}[X]$

$$= \frac{n_{ca}}{nc}[X] \text{.....(1)}$$

Therefore, the total weight of impact factors T, S, E, and Ev where (P_z) is the last parameter of the impact factors is calculated as follows:

$$T_v = \frac{\frac{5P_1n_{ca}}{P_1n_c} + \frac{5P_2n_{ca}}{P_2n_c} + \frac{5P_3n_{ca}}{P_3n_c} + \text{.....} \frac{5P_zn_{ca}}{P_zn_c}}{N} \text{.....(2)}$$

$$= \frac{5\left[\frac{P_1n_{ca}}{P_1n_c} + \frac{P_2n_{ca}}{P_2n_c} + \frac{P_3n_{ca}}{P_3n_c} + \text{.....} \frac{P_zn_{ca}}{P_zn_c}\right]}{N} \text{.....(3)}$$

T = $\frac{37}{55} = 0.672$ .....(4)

S = $\frac{16}{20} = 0.800$ .....(5)

E = $\frac{12}{35} = 0.345$ .....(6)

$$\mathbf{Ev} = \frac{24}{35} = 0.686 \quad \text{.....(7)}$$

From the result shown above, quality performance results for the four impact factors measured in a UK affordable housing scheme are respectively less than 1 and hence validates for the proposed benchmark. Toolkit development and implementation is a highly essential part of a good benchmark.

8.3.3 AHQB Model

The proposed affordable housing quality model comprise of six (6) concentric circles with 29 radial lines originating from the centre and linking the centre with all the circles. The centre is at point 0 (point of no quality attainment), while the radial lines meet the other concentric circles at regular intervals from the centre with the 5th circle at point 5 (point of highest quality attainment). The radial lines represent the 29 parameters on the toolkit. The last band between circle 5 and 6 is divided into 4 sectors which represent the 4 impact factors being considered in this research (i.e. Technological, Sociological, Economical and Environmental). While the red line represents the benchmark based on empirical analysis, the green line at 2.5 point is considered in this research as the least permissible limit. The entire gray shaded area represents the benchmark for quality.

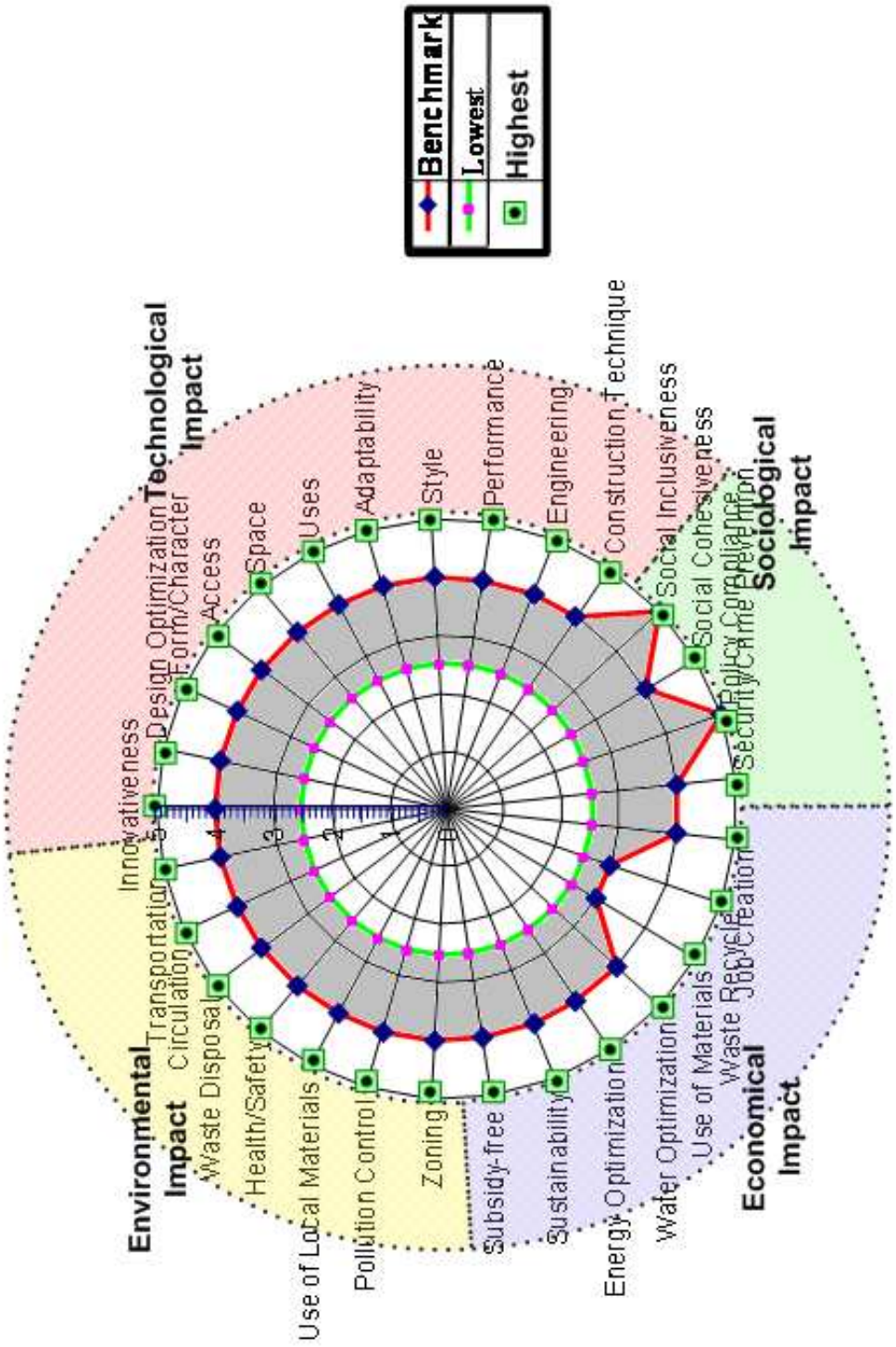

Figure 8.3: AHQB Model indicating quality levels of parameters

8.4 VALIDATION AND IMPLEMENTATION OF QUALITY BENCHMARK MODEL

Validity has been defined by various researchers from wide range of perspectives considering the research construct; analytical process or the methodology. Hair *et. al.* (1995) defines 'Model Validation' as the process by which the ability of the model to do what it sets out to achieve is assessed. The methodology defined by Hair *et. al.* (1995) will be adopted as the process for validating the model developed in this research.

This chapter describes the aim of this validation, how the validation was carried out; the result of the validation and the implementation routes for the quality benchmark model. In this section, the proposed model and the toolkit were used on existing affordable housing schemes to ensure that they accomplish what they were originally set to accomplish. The data used for validation was collated from one of the organizations that earlier participated in data collation through questionnaire. Using benchmark framework under expert panel empirical validation method, this study as highlighted in Table 8.1 was validated.

Table 8.1 Methods of Comparison for Quality Framework Validation (Inglis, 2008)

Quality Framework	Author(s)	Validatic Context/	Validation Method					
			Literature Review	Expert Pan Empirical	Empirical Research	Survey Research	Research Pilot Proje	Case Studie
Quality Improvement Framework	Inglis et al.	Australia						
Benchmark Framework	McKinnon (2000)	Britain, A						
Benchmark for Success Internet-based Distance Education	Phipps and Merisotis (	USA						
Universitas 21 Framew Quality Assurance	Chua and L (2007)	Unspecifi						
ACODE e-learning Benchmarks	Brigland a Goodacre (	Australia						
Proactive Evaluation Framework	Sims et al (	NA						
Quality Preference Fran	Ehler (200	Europe						

8.4.1 Affordable Housing Toolkit Refinement and Validity

It is crucial in evolution of a fundamental body of knowledge in any management theory to develop genuine measure to obtain valid and reliable estimates of the organization-level constructs and their relation to another (Shureschchander *et al.*, 2001).

The onus of initially identifying the intrinsic dimensions of quality management, checking that they are measured reliably, validly and subsequently ascertaining their influences on organisational performance lies on research (Flynn *et al*., 1994). However, a reliable and valid affordable housing quality benchmark is a function of a reliable and valid measuring instrument (toolkit). Hence, the primary focus in this research was to put right the scale (toolkit).

8.4.2 Uni-dimensionality analysis of (AHQB) Model Fitness

Unidimensionality analysis is part of series of tests adopted in this study to assess if the multiple measures introduced while developing AHQB model can be regarded as alternative indicators of same construct. Hattie (1985, p.49) in Gerbing and Anderson (1988) clearly stated, "That a set of items forming an instrument all measure just one thing in common is a most critical and basic assumption of measurement theory". This is significant because there may be variations in perception of meaning of a measure between a researcher and a respondent.

Without the concept of unidimensionality, it is extremely difficult to represent the value of a scale with a solitary number (Venkatramann, 1989). While checking for unidimensionality, a measurement model is specified for each construct and (EFA) is run for all construct. An investigation of individual items in the model is required to determine how closely they represent the same construct (*Ahire et al*., 1996).

Comparative fit index (CFi) as indicated in table 8.2 is significant in this study as an instrument used in drawing comparison of quality measures taken through questionnaire and case studies data. Also scale reliability is satisfied for a scale with 0.70 and above measures, while converge validity is satisfied with 0.90 and above measures. These have been respectively satisfied with the measures shown in this table.

Table 8.2 Unidimensionality; converge validity and Scale Reliability

Impact Factors	Comparativ Index (Cfi)	Cronbacl Alpha (^	Bentler-Bor Coefficient (
TECHNOLOGICA	0.91	0.78	0.99
SOCIOLOGICAL	0.94	0.75	0.90
ECONOMICAL	0.97	0.86	0.91
ENVIRONMENTA	0.90	0.86	0.92

NOTE: CFI value of 0.90 above testifies strong scale unidimensionality.

A value of 0.70 **(^)** above testifies strong scale reliability.

A value of 0.90 (▲) above testifies strong scale converge validity.

8.4.3 Coefficient of Variability

This is a statistical standard deviation of a variable relative to its mean. It is often used with ratio scale variables where zero is an absolute zero point ie. 0 = nothing. Let 'mean' be denoted with $\overline{X}$ and 'standard deviation' (S). Therefore, the coefficient of variability (CV) is denoted with CV= [(100) (S)/ $\overline{X}$]. It was adapted in this research as a technique to further test reliability of the benchmark measures. Comparison of the 'standard deviations' of variables measured in two different units of measurement is sometimes interesting (Friel, 2009). It may also be used to 'test for reliability of the scale'. In this research, measurements were taken from the variables of the impact factors being investigated as part of the process to quality benchmark development: The first as the outcome of questionnaire survey on 10 Affordable housing projects and the second as the outcome of case study conducted on same 10 affordable housing projects. Both of these assessment exercises resulted in measurement of common variables as indicated in Table 8.3. The mean and standard deviation symbols for these measurements taken in the study are indicated in table 8.4, while table 8.5 shows

the outcome of coefficient of variability from the measurements for the impact factors using the equation shown

SERIAL No.	IMPACT FACTORS	CASE STUDIES (*QII*)	RANK (*Ri1*)	MEAN	STANDARD DEVIATIO	QUESTIONNAIRE (*QI*	RANK (*Ri2*)	MEAN	STANDARD DEVIATIO
1	Technological	0.709	4	0.614	0.725	0.628	3	1.590	1.371
2	Sociological	0.850	1	0.735	0.852	1.000	1	1.790	2.113
3	Economical	0.714	3	0.494	0.134	0.446	4	1.475	0.931
4	Environmental	0.800	2	0.697	0.955	0.800	2	1.727	1.955

Table 8.3 Outranking of Impact factors within Questionnaires/Case Studies

Table 8.4 Mean and Standard Deviation Measurements

Measurement by Questionnai	Measurement by Case study
Mean ($\overline{X}$) Standard Deviation(S)	Mean ($\overline{X}$) Standard Deviation (S)

Let ($\overline{X}$) represents Mean; (S) represents Standard Deviation and CV represents the Coefficient of Variability.

Where:

$$(CV_{\textit{measurement by questionnaire}}) = (100)\,(S)/\,(\overline{X})$$

$$(CV_{\textit{measurement by case study}}) = (100)\,(S)/\,(\overline{X})$$

Table 8.5 Coefficient of Variability

IMPACT FACTORS	CASE STUDIES DATA	QUESTIONNAIRE DATA
TECHNOLOGICAL	$\frac{100}{1} X \frac{0.725}{0.614}$ =118.078	$\frac{100}{1} X \frac{1.371}{1.590}$ =86.226
SOCIOLOGICAL	$\frac{100}{1} X \frac{0.852}{0.735}$ =115.918	$\frac{100}{1} X \frac{2.113}{1.790}$ =118.044
ECONOMICAL	$\frac{100}{1} X \frac{0.134}{0.494}$ =27.125	$\frac{100}{1} X \frac{0.931}{1.475}$ =63.118
ENVIRONMENTAL	$\frac{100}{1} X \frac{0.955}{0.697}$ =137.015	$\frac{100}{1} X \frac{1.955}{1.727}$ =113.202

The foregoing result indicates that the variation in the case studies are greater than the variations in questionnaires relative to their means for technological and environmental impact factors, but less for economic and sociological impact factors.

8.4.4 Tests for measuring (AHQB) Model Fitness and validity

A good fitness model is not necessarily a valid model. Fitness of a model refers to the ability of the model to reproduce the data. A model of whose parameters are zero is a 'good-fitting' model.

The purpose of validity is to establish fitness of purpose. A quality framework is fit for purpose, if it is able to support the type of assessments needed for quality processes (Inglis, 2008). Therefore, validity of the proposed model was conducted using the method mostly used for validating benchmarking frameworks (McKinnon et al, 2000). Inglis, (2008) was of the opinion that case studies may be used for validation when quality framework is derived from existing practice rather than being created for the purpose of establishing a new set of practices. Such was the situation with the proposed (AHQB) model which was derived from existing

practice of affordable housing quality in the built environment.

8.4.5 Comparative Fit Index (CFI) Tests

Comparative Fit Index is directly based on the non-centrality measure. If (X^2) is Chi Square and the degree of freedom of the model is *(df)* and $d = X^2 - df$.

Therefore:

$$\text{Comparative Fit Index (CFI)} = \frac{d(NullModel) - d(\text{Pr}\,oposedModel)}{d(NullModel)}$$

-If the index > 1, it is set to 1; and if the index is < 0, it is set to 0

-A lower value for D implies a better fit.

-If the CFI < 1, then it is always greater than Tucker Lewis Index (TLI).

-The CFI pays a penalty of one for every parameter estimated.

$$\text{T} = \frac{d(0.628) - d(0.709)}{d(0.628)} = -0.12898 \text{ (Therefore this set to [0])}$$

$$\text{S} = \frac{d(1.000) - d(0.850)}{d(1.000)} = 0.15 \text{ (Therefore this is set to [1])}$$

$$\text{E} = \frac{d(0.446) - d(0.714)}{d(0.446)} = -1.154897 \text{ (Therefore this is set to [0])}$$

$$\text{Ev} = \frac{d(0.800) - d(0.800)}{d(0.800)} = 0 \text{ (Therefore this is set to [1])}$$

The result above shows that the (AHQB) model is at the greatest fit for Economical impact factor and least at Sociological. A model with about 75 to 200 cases is considered a reasonable measure of fit, though; there are no consistent standards for what is considered an acceptable model. Models with more cases almost always statistically have Chi Square as being significant (Chen *et. al*., 2008). The size of

correlation in a model also affects 'Chi Square'. Hence, the larger the correlation, the poorer the fit thereby requiring other alternative measures for fitness. The (AHQB) Model has 29 cases (parameters) which is far less than 75 and so is considered of a good fit.

8.4.6 Steps toward Implementation of Affordable Housing Quality Benchmark (AHQB) Model

To meet up with the need for providing the right homes in the right places for UK growing and diverse homeless communities and also ensuring that people who need good quality home are able to live independently as part of the community, AHQB is deployed to ensure the provision of appropriate homes and supporting facilities. Peoples' quality of life is reduced, hence, discouraging anti-social behaviour by providing sufficient supply of good quality homes necessary to sustain and advance economic growth.

Therefore, it becomes essential to implement (AHQB) model to realize these. The implementation of AHQB model requires following 7 sequential steps of operation. The more these steps are repeatedly implemented, the greater the incremental quality change is recorded. These steps are:

Step 1: Plan

Expected Affordable Housing Quality Benchmark (AHQB) model implementation involves identification of the goals, objectives and expected outcome of the benchmark activities. At this stage, it is relevant to determine how important it is to measure whatever is to be measured. Care should be taken to measure only

things that are relevant because measuring too many things may result in confusion. Figure 8.1 is a guide to effective quality benchmark planning. To conduct an effective quality benchmark, proper procedure must be adhered to. This entails firstly, assessing the needs of the intended occupants of the scheme and also selecting goals. This is followed by outlining the objectives of these goals. The goals and the objectives will determine what to look out for during assessment. However, if it is the initial circle of benchmark, the goals and the objectives will be guided by the assessed needs, otherwise, the will be guided by the outcome of previous circle of benchmark activity.

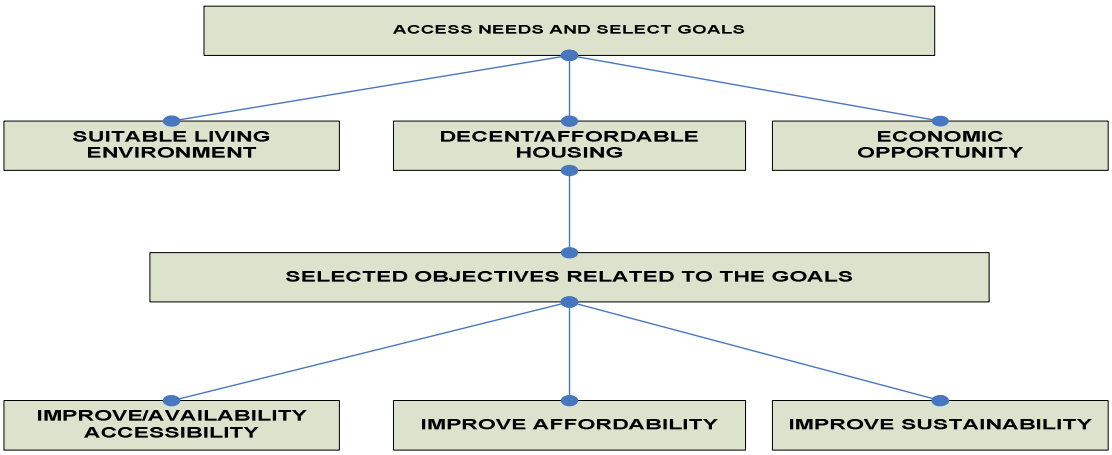

Figure 8.4: Planning Guide to Quality Benchmark Implementation

Step 2: Measure

Step 2 of this procedure considers how data will be collected. This step also includes determination of how measurement was conducted. Measurement was

done in this research using proposed AHQ toolkit which comprises of 4 impact factors; 29 parameters and many criteria which are expandable (see APPENDIX 6). Any affordable housing scheme is measured against set criteria shown in section A of the toolkit. The check box attached to each criterion indicates if the criterion is achieved when ticked (√) or not when empty. This was subsequently transferred to the data sheet in section B, which immediately precedes section A in the proposed toolkit, with each scheme on separate toolkit data sheet. This indicates how many of the set criteria, were achieved by each scheme.

Step 3: Compare

The knowledge of the type of benchmarking activity to be applied in any case is essential in proceeding to this step. This helps to also determine the structure of the comparison to adopt. As earlier indicated in chapter 2, it could be internal, external, competitive, and generic. Cumulative of the presence of the criteria in each parameter determines the (weighting) of the parameter or the parameter importance index. Subsequent comparison of the weightings for all schemes reveals inadequacies or performance of each affordable housing scheme. This comparison is done on 'like to like' parameters or by pair wise comparison for a collection of affordable housing schemes in an area. An outcome of this comparison indicates the scheme that outperformed the others or the parameters that should be given greater attention during step 6 (Act).

Step 4: Analyse

In this step, the 'qualitative outranking method' of muti-criteria analysis (MCA) is recommended for use. Nijkamp and Van Delft (1977) suggested use of this method in their study based on the assumption that performance on each criterion is categorised into four categories. In this research, however, this method is adopted

at the level of analysis for the parameters, and the performance on each parameter is categorised under five impact levels (Highest [5]; High [4]; Middle [3]; Low [2]; Lowest [1]) impacts. These weightings also cumulate for each impact factor based on same coding for the parameters.

The overall weightings for the impact factors are finally compared with established 'Reference Quality Benchmark' (QI) for same impact factors.

Step 5: Set

In this step, the outcome of the analysis in step 4 was presented in such an interactive way as to easily communicate with a greater audience. This is significant under a situation where a thought-through discussion with experts and decision makers in the field of study is relevant to identify issues responsible for low performances recorded in some parameters and also ways to address the deficiencies. In such situations, there is need for feedbacks from the developers.

Step 6: Act

In this step, measures based on feedback from step 5 are taken to appropriately address the inadequacies identified during the impact assessment earlier on conducted on the schemes. Specific criteria were cross-checked to confirm their consideration on each scheme. However, there are some criteria that are difficult or even impossible to change, except if the scheme is demolished, for instance, location, orientation, and design a normally. Note that some information collected on assessed schemes can also be used for subsequent decision making for improved quality in design, planning and construction of affordable housing.

Step 7: Review/React

The circle of benchmarking can not be said to be complete without confirming that the inadequacies identified during impact assessment has been completely addressed. This step is the part that makes benchmarking a continuous exercise. Hence, this aspect responds to the identified needs or deficiencies during benchmark implementation.

8.5 CHAPTER SUMMARY

This chapter highlights the framework of the (AHQB) model and the key components of affordable housing quality toolkit. It also streamlined the development process for affordable housing quality benchmark model and procedure for assessment of quality using the model. Empirical and visual models are all parts of this developmental process. The theoretical paradigm for this study was also located within this chapter with categories of viewpoints for the theoretical framework.

The procedure and technique for testing and validating AHQB model was also clearly presented. Various types of validity construct adopted in this study were also mentioned and analysed. Generally, research validation methods trailed every step of this study. Some at a preliminary stage and others at a tertiary stage through: Literature review; Case study; Pilot study questionnaire survey; Empirical research and expert panel empirical. However, 'Expert Panel Empirical' validation method was hugely highlighted because it draws on other methods as it develops into a crowning validity method with comprehensive feedback

concerning the functionality of the AHQB model from built environment experts. Also included in this chapter are: the step-by-step procedure for implementing the AHQB model.

CHAPTER 9

9.0 CONCLUSION AND RECOMMENDATION FOR FUTURE WORK

9.1 INTRODUCTION

This chapter provides a summary of all conclusions from the preceding chapters in this study. This includes a brief account of the outcome from questionnaire survey; case studies; hypothesis; research questions; aim and objectives of the research. Also included are the research contributions to knowledge; recommendations to practitioners and future research recommendations.

This research exploits the efficacy of benchmark system as a strategy for continuous improvement of quality affordable housing delivery in UK. This was done by initially identifying relevant Key Performance Indicators (KPI)'s; benchmark models; construction toolkits and quality of affordable housing projects. Thereafter, an investigative case study was conducted on samples of award winning projects, followed by a comparative analysis on their qualities. This contributed to customization of an integrative heterogeneous toolkit as part of the benchmark model to fill-in identified gaps. Finally, solutions for monitoring and balancing overall quality of affordable housing delivery in UK were recommended.

9.2 OVERVIEW OF RESEARCH FINDINGS

This section of the study present all the findings made in this study as shown in the following sub-sections: These findings were derived from data collated from questionnaire survey conducted on UK affordable housing practitioners.

9.2.1 General Background of Affordable Housing Practitioners

Some practitioners in the built environment are considered more significantly positioned to effect meaningful changes than others, being that they are directly involved in the improvement and maintenance of affordable housing quality scheme. However, findings from this study show these practitioners and their roles relative to all other practitioners could hardly shift. Findings from pilot study conducted earlier in the study suggested that, of all the respondents to the pilot study questionnaire, a few of them were really concerned with quality issues as concerns affordable housing. It further revealed that some practitioners openly wondered what their role should be in the whole picture of quality improvement.

All the respondents to pilot study questionnaire were not equally aware of the relevant details of quality improvement, hence the impact level shifts from one group of practitioners to another. Records show that Architects recorded highest with 69.2% and closely followed by non-architect developers with 25% and finally contractors with 5.8%. Other practitioners like Engineers, Planners, Builders, and Sub-contractors recorded 0% respectively.

9.2.2 Use of Spaces, Materials and Forms in Design

The application of spaces, materials and forms during Affordable Housing design and development was one of the relevant aspects of the findings that have direct bearing on the Architect than any other practitioners.

Application of spaces, materials and forms could make or mar the quality of affordable housing development. The impact could be indoors or outdoors. For instance, a left over space under a staircase could be used for a number of purposes in design. It could be used as a storage compartment; as a coat or umbrella rack; as a visitor's toilet or left out in the design. Never the less, the judgement of the designer within the context of the concept is essential for determining how affordable and qualitatively enhanced the final output becomes. Also the application of solar panels as roofing sheets could be seen as a quality criterion for affordable over a foregone alternative of roofing shingles, however, the application of these criteria should be such that it does not turn a supposed solution into a new problem. Out of 10 schemes investigated, about 80% hardly maximized exploitation of design as an integrating tool between indoor and outdoor spaces.

9.2.3 Housing Construction and Refurbishment

In the UK, the construction of new build affordable housing is greatly guided by a number of policies, ranging from land, zoning, economic, planning, design and social policies. Most times, some of these policies come at cross purpose with each other to negatively impact on the quality of affordable housing. For example, the brown field policy which encourages development of pre-used plots over

Greenfield does not take adequate cognisance of the location of available brown fields relative to (proper zoning) which is considered attribute for good quality affordable housing. Affordable housing quality with respect to proper location is greatly impacted on if this is strictly adhered to. In other words, the available brown field for affordable housing may not be at best suitable for good quality development.

Application of construction system may also negatively or positively impact on affordable housing quality. If a system has been thoroughly researched into with repeated usage and testing, there is greater likelihood of such a system being more reliable than when it has not been repeatedly used and tested. Table 9.1 shows the greatest application of a combination of different systems in a hybrid circumstance than each system. The least used systems are volumetric and Pod (Bathroom/Kitchen) system of construction as shown in table 9.1.

Table 9.1 Relative Application of Construction systems by Developers

AFFORDABLE HOUSING QUALITY VARIABLES		Traditional system of Building	Volumetric System of Building	Panellised System of Building	Pod (Bathroom/Kitchen)	Light Weight Cladding	Hybrid System of Building	Sub-assemblies and components System of Building
Traditional system of Building	**A**							
Volumetric System of Building	**B**	A						
Panellised System of Building	**C**	A	C					
Pod (Bathroom/Kitchen)	**D**	A	B	C				
Light Weight Cladding	**E**	A	E	,CE	E			
Hybrid System of Building	**F**	F	F	F	F	F		
Sub-assemblies and components System of Building	**G**	A	G	C,G	G	E,G	F	

The prevalence of relative application for these systems in the UK housing construction are as follows: hybrid system of building =7;traditional system of building = 5; panellised system of building = 4; light weight cladding = 3; sub-assemblies and components system of building = 2; pod (bathroom/kitchen) = 0; volumetric system of building = 0.

9.2.4 Application of Built Environment Toolkits and Innovative Ideas

Application of built Environment toolkit and innovative ideas are some of the ways by which quality of affordable housing scheme could be improved by the developers. In this study, data from questionnaire respondents (refer to figure 9.1 below). The figure shows that out of 9 built environment toolkits listed in the questionnaire, 22.2% of the respondents overwhelmingly agree that Design Quality Indicator (DQI) and Housing Quality Indicator (HQI) were essential in improving the quality of affordable housing. The remaining 78.8% indicated that they had no opinion concerning the use of any of the listed built environment toolkits. This data shows that the use of built environment toolkits for improvement of affordable housing quality by developers in UK is limited.

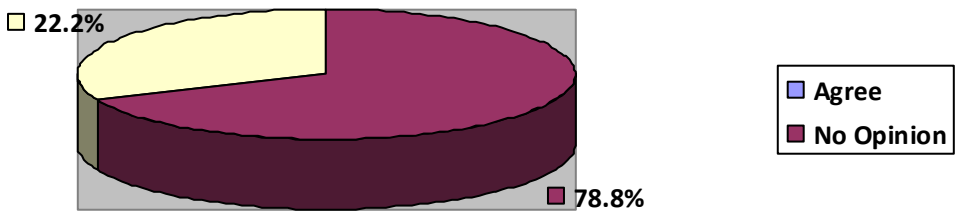

Figure 9.1: Result of toolkit usage and innovative ideas by developers

As it has been for every research, the primary focus has been on being able to provide meaningful answers to all outlined research questions, satisfying the research hypothesis and achieving the aim and objectives for the study. This section shows how these requirements were met.

In this study the conceptual quality framework for affordable housing quality model (AHQM) commenced towards the end of chapter 3. This conceptual framework was derived from existing UK built environment toolkits and quality standards. A review of UK built environment toolkits; quality standards and benchmark models from chapters 1-3 gave an insight into the needs for a customized affordable housing quality model.

The BIS (KPI) template has the reputation of being associated with all reviewed UK built environment toolkits in this study, and has been proved credible by experts in the field. The strategy as revealed by the review lies in identifying the existing needs and developing solutions considering identified needs. Taking a cue from this strategy, it became essential to carry out case studies of existing Affordable housing projects to identify their quality needs before customising the KPIs for the toolkit. By so doing, the relevant quality needs and deficiencies of UK Affordable housing were captured in the toolkit and satisfied in the comprehensive nature of the proposed toolkit.

9.2.5 General Questionnaire Feedback from Developers

One of the general comments offered by the developers is 'that the best influence for high quality housing is to undertake a thorough design process – to ensure an appropriate solution and best value for money at the outset. Every project is different, serving different needs and different contexts. Technical and design guidelines can be a useful tool, but do not ultimately deliver quality. A good design team, an enthusiastic, committed client and (where appropriate) strong stakeholder involvement (including local residents and planning officer) are every bit as important as guidelines and toolkits. Every project is different – so different materials and techniques will be appropriate. We recommend a bespoke solution to suit each context/brief.

9.2.6 Criteria for the Success of AHQB Model use

While using AHQB model, it is recommended that the following set of criteria be achieved for optimum output from the model. The prescribed set of criteria is as follows:

- Although the number of criteria in the toolkit is expandable, it should be made to remain constant throughout the period of measurement.
- Measurements should be made to cover the four key impact factors being assessed and respectively referenced to the overall criteria on each factor of the toolkit.
- Values achieved for quality impacts are expected to be respectively either equal or less than the reference values (benchmark) for the impact factors.

- Whenever any measurement exceeds the already established benchmark,, a new benchmark is established and should automatically replace the existing.

The benchmark model is said to be validated if all the conditions prescribed in the tests are fulfilled. Otherwise, subsequent modifications and tests are recommended as a follow-up re-examination and adjustment to this research process and output.

9.3 RECOMMENDATIONS FOR PRACTITIONERS

For effective output from affordable housing quality benchmark, practitioners are advised to view the application of this tool and the benchmark as a continuous exercise aimed at the deficiency of their schemes. Therefore, the result of each circle of benchmark exercise should be used as a reference point for the new circle of benchmark and thereby consolidate on already achieved criteria.

To ensure continued effectiveness with improvement of affordable housing quality, it is recommended for all developers to ensure the proper use of AHQ Toolkit with relevant existing UK Quality standards. At each circle of usage the identified deficiency or needs should be made to be the target aim for the next circle. Therefore, the benefits of the exercise tend to be evident in the continual process rather than in one off exercise.

9.4 RECOMMENDATIONS FOR FURTHER RESEARCH

Having justified the need for a customised toolkit for this research based on the framework of four impact factors and also determined a proposed quality benchmark for UK affordable housing. This study has provided a viable spring board from where further research could sprout. In research, and also in benchmark technique, a continuous assessment is essential for effective validation. This study has provided an opportunity for re-validation, so as to accommodate any changes that may occur within the constituted parameters and their criteria arising from dynamism in technology; automation; policy or other unforeseen factors.

9.5 CHAPTER SUMMARY

This study is poised to fill the gap created by inadequacy of existing tools and benchmark models through proper identification of the criteria responsible for quality improvement in affordable housing. This inadequacy exists because the purpose for which they were designed was inconsiderate of specific nature of affordable housing schemes. Consequently, this study has part of its output dedicated to customised affordable housing quality toolkit. This was made possible by adapting Department of Trade and Industry (KPI). This toolkit will be used for quality impact assessment for UK affordable housing, leading to benchmark development.

Although serious gaps exist within UK affordable housing quality benchmark literature and were identified, evidence from the past experience offers a lot to today's policymakers and practitioners. Whereas the problem of good quality affordable housing is consequence of non-collaborative nature of existing standards, solution to poor supply of quality affordable housing does not merely lie with designing the right toolkits. It also reaches out to coherency of purpose in a single benchmark system, embracing all components of quality delivery. These components of quality delivery should be made to include design; policy framework; delivery process; cost reduction; technological innovation; and partnership of the supply chain and entire stakeholders. This study also suggested solutions to this through developing a comprehensive and collaborative benchmark model for monitoring delivery of good quality affordable housing in UK.

Studies earlier conducted in this area of study identified fundamental deficiency with the existing toolkits and strategies that failed to integrate all parameters for measuring affordable housing quality. They also failed to draw lessons through impact assessment for the existing situation in terms of affordable housing quality. Hence, application of a collaborative system through benchmark models on a viral base of expertise was required to transform quality of affordable homes in UK to greater height. Therefore, efficacy of benchmark system as a strategy for continuous improvement of quality affordable housing delivery in UK is hereby established.

REFERENCES AND BIBLIOGRAPHIES

Achen, C.H. and Duncan, S. (1989) Rational Deterrence Theory and Case Studies. *World Politics* 41(January): 144-69.

Adrian, Y. And Print, M. (2004) *KPI and Benchmark: Best Practice Guide,* Constructing Excellence, (accessed on 13th September, 2006) available at: www.kpizone.com.

Ahadzie, D., Proverbs, D. and Olomolaiye, P. (2007) Critical Success Criteria for Mass House Building Projects in Developing Countries*, International Journal of Project Management*, Elvier Ltd and IPMA, pp. 1-13.

Ahire, S.L. (1996) ''TQM age versus quality: an empirical investigation'', *Production and Inventory Management Journal*, first quarter, pp. 18-23.

Ahire, S.L., Golhar, D.Y. and Waller, M.A. (1996) ''Development and validation of TQM implementation constructs'', *Decision Sciences*, Vol.27, pp. 23-56.

Allison, J. (2002*)* Multifamily Housing and the Secondary Market: Opportunities for Financing Affordable Housing, *D J. Evans School of Public Affairs*, Washington.

Anderson, D. (2004) Towards Development of Scale to Measure 'will' to Promote Heart within Health Organizations in Canada, *Health Promotion International*, Vol. 19, No. 4, Oxford, pp. 471-481.

Andrew, F. (2005) *UK house prices consumption and GDP in a global context*, University of Oxford, Oxford, UK.

Atkinson, G. (1987) *A guide through construction quality standards,* Van Nostrand Reinhold, Berkshire, pp.88.

Barton, H., Grant, M. and Guise, R. (2003) *Shaping Neighbourhood: A Guide For Health, Sustainability And Vitality*, Spon Press, London.

Bates, R., Best, R. and Holmans, A. (2000) On the move: The housing consequences of migration, *Joseph Rowntree Foundation*, York.

Batista, G.E.A.P.A. and Monard, M.C. (2002) *A Study of K-Nearest Neighbour as an Imputation Method,* in Abraham, A. et al. (Eds) Soft Computing Systems: Design Management and Applications, IOS Press, Amsterdam, pp. 251-260.

Bazeley, P. (2002) Issues in Mixing Qualitative and Quantitative Approaches to Research, *1st International; Conference-Qualitative Research in Marketing and Management*, University of Economics and Business Administration, Vienna.

Beatham, S. (2003) Development of Integrated Business Improvement System for Construction, *Department of Building and Civil Engineering, University of Loughborough,* Leicester.

Beatham, S. Anumba, C. and Thorpe, T. (2004) KPI: A Critical Appraisal of their Use in Construction, *Benchmarking: An International Journal,* Vol. 11, No. 1, pp. 93-117.

Birch, J. (2005) House Audit: Assessing the design quality of new homes in the North East, North West and Yorkshire & Humber, *Commission for Architecture and the Built Environment,* London.

Birch, J. (2005) *What it's like to live there: the Views of Residents on the Design of New Housing*, London.

Birch, J. (2007) *Housing Audit: Assessing the design quality of new housing in the East Midlands, West Midlands and the South West*, CABE Research Publication, London, p.4, 56-58.

Bohrnstedt, G. (1983) Measurement, in Rossi, P., Wright, J. and Anderson, A. (Eds), *A Hand Book of Survey Research*, Academy Press, San Diego, CA.

Bonfield, P. (2005) *Offsite 2005: Modern Method of Construction Come Age*, Watford, Pg 6-23.

Boselie, P. and Wiele, T.(2002) Employee perception of HRM and TQM, and the effects on satisfaction and intention to leave*, Managing Service Quality*, Vol. 12, No.3, pp165-172.

Brandon, P. (1984) Cost versus quality: a game? *Construction Management and Economics*, 2: 111-126.

Brophy, P. and Woodhouse, S. (2003), *"Evaluation and impact assessment for NOF Digitise projects: an information paper from the NOF Technical Advisory Service"*, accessed Nov.2007) at: http://w.w.w.ukoln.ac.uk/nof/support/help/papers/impact-assessment/

Browne, M.W. and Cudeck, R. (1993) Alternative Ways of Assessing Model Fit *in* Bollen, K. A. and Long J. S. (eds.) *Testing Structural Equation Models,* Newbury Park, CA, Sage Publication, pp. 112-136.

Buki, C. (1995) *Part I: The Great Production Debate*, Shelter force Online, National Housing Institute, (accessed February 2008) http://www.nhi.org/online/issues/82/debate.html

Bureau for Development Policy (2005) *Measuring Capacities: An Illustrative Catalogue to Benchmarks and Indicators,* UNDP Resource Catalogue, New York, pp. 2-28.

Commission for Architecture and the Built Environment (2005a) *Winning housing designs: Lessons from Anglo-French housing initiative,* London.

Commission for Architecture and the Built Environment (2005b) Housing Audit: Assessing the Design of New Homes in the North East, North West and Yorkshire & Humber,

Commission for Architecture and the Built Environment (2007) *It's our space: A guide for community groups working to improve public space,* London.

Cairncross, L., Downing L., and Green S. (2004), *Planning for Affordable Housing: Lessons from the English Park*, Paper to the Housing Studies Association Conference, Belfast.

Carmona, M. (2001) *Housing Design Quality: Through Policy, Guidance and Review,* London, pp. 44-61.

Carrizosa, E., Conde, E., Fernandez, J. and Puerto, J. (1993) Theory and Methodology: Multi-criteria analysis with partial information about the weight coefficients, *European Journal of Operational Research,* 291-301.

Chan, D.W.M. and Kumarraswamy, M.M. (1997) A comparative study of causes of time overruns in Hong Kong construction project*, International Journal of Project Management*, Elsevier Science Ltd and IPMA, pp. 55-63.

Chan, E. and Yu, A. (2005) Contract Strategy for Design Management in the Design and Build System, *International Journal of Project Management*, 23, pp. 630-639.

Chapman, R.L. and Hyland, P.W. (1997) Continuous Improvement Strategy Across Selected Australian Manufacturing Sectors, *Benchmarking for Quality Management and Technology,* 4(3), pp. 175-88.

Chapman, K. (1999) *Dissatisfaction with stock Condition Survey in Social Housing*, MCB, Vol. 17, pp. 211-215.

Chapman, P. E. et al. (1998) *Poverty and Exclusion in Rural Britain: the dynamics of low income and employment,* The Arkleton Centre for Rural development Research, Aberdeen.

Charantimath, P. M. (2006) *Total Quality Management*. Dorling Kindersley, Pvt. Ltd., Delhi, India.

Cheng, E. and Li, H. (2004) A learning culture for strategic partnering in construction, *Construction Innovation*, 4, pp. 53-65.

Chinyio E. and Boyd, D. (2003) Benchmarking Innovation In Public Private Partnership Scheme, *Proceedings of COBRA*, Wolverhampton, pp. 67-78.

Chiu, R. L. H. (2004) *Socio-Cultural Sustainability of Housing: A Conceptual Exploration*, *Housing, Theory and Society*, Taylor and Francis, ISSN 1403–6096, Vol. 21, No 2, pp. 65-76.

Clark, A., Fenton, A., Markkanen, S. and Monk, S. (2008) Understanding Demographic, Spatial and Economical Impacts on Future Affordable Housing Demand: Paper Two-Living in Affordable Housing, Cambridge Centre for Housing and Planning Research, pp. 1-12.

Clemes, M. (2004) Visual Models, *Idiagram*, Accessed on 22/02/2010, available at: http://www.idiagram.com/ideas/visual_models.html

C.L.G. (2007) *Homes for the future: more affordable, more sustainable,* London, pp. 15-17 and 57-67,

Coakes, S.J., and Steed, L.G.(2001) *SPSS: Analysis without Anguish: version10.0 for windows,* Milton.

Collier, D. (1991) The Comparative Method: Two Decades of Change. in Comparative Political Dynamics (eds.) D. A. Rustow and K.P. and Erickson. New York: Harper Collins, pp. 7-31.

Constructing Excellence, (2004) *KPI and Benchmark: Best Practice Guide*, London, pp. 17.

Constructing Excellence (2006) Smarter Business Practice through Benchmarking: *The Housing Forum Benchmarking Club HouseBench.com*, London, pp. 2-4.

Constructing Excellence, (2004) *UK Construction Industry: Construction Industry Key Performance Indicators*, London, p. 45.

Costa, D., Formoso, C., Kagioglou, M., and Alarcon, L. (2006)Performance measurement systems for benchmarking in the construction industry, *Proceedings of World Conference on Accelerating Excellence*, Birmingham.

Costa, D. B., Formoso, C. T., Kagioglou, M., Alarcón, L. F. and Caldas, C.D. (2006) Benchmarking Initiative in the Construction Industry: Lesson Learned and Improvement Opportunities, *Journal of Management In Engineering*, Vol. 22, No. 4, pp. 158-167.

Creswell, J. W. (2003) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd edition, California, Sage Publication Inc.

Creswell, J.W. and Plano-Clark, V.L. (2007) *Designing and conducting mixed methods research*, 2nd edition, California, Sage Publication Inc.

Dacquisto, D. and Rodda, D. (2006) *Housing Impact Analysis,* U.S. Department of Housing and Urban Development Office of Policy Development and Research, [accessed 18th February 2008]. Available on: <http://www.huduser.org/publications/affhsg/hsgimpanal.html>

David Cumberland Housing Regeneration Ltd (2005) *The Golden Triangle Affordable Housing Project: Affordable Housing Good Practice Manual: Delivering Affordable Housing through Section 106 agreement,* Cheshire.

Davis, P. (2005) *A Sustainability Impact Study of Additional Housing Scenario in England*, O.D.P.M. Research, London.

Davis, S. (1997) *The Architecture of Affordable Housing*, University of California Press, California.

Daws, K.M., Ahmed, Z.A. and Moosa, A.A. (2009) An Intelligent Quality Function Deployment (IQFD) for Manufacturing Process Environment*, Jordan Journal of Mechanical and Industrial Engineering,* Vol. 3, No. 1, pp.23-30.

Department of Community and Local Government (2009) Multi-Criteria Analysis: A Manual, Department of Community and Local Government, London, pp. 1-168.

Dent, R. and Story, D. (ed.) (2004) *Benchmarking the Performance of Design Activities in Construction*, London, pp. 58.

Department of the Environment, Transport and the Regions (2000) KPI Report for the Minister for Construction, KPI Working Committee, London.

Dewick, P. and Miozzo, M. (2004) Network and Innovation: Sustainable Technologies in Scottish Social Housing, *Research and Development Management*, 34, 3, pp. 323-333.

Di, Z. and Liu, X. (2006) The Effect of Housing Push Factors and Rent Expectations on Household Formation of Young Adults, *Journal of Real Estate Research*, Vol.28 No.2, pp. 149-166.

Diacon, D. and Guimarães (2005) Presentation of the world habitat awards, *Building and Social Housing Foundation*, World Habitat Day 2005, Jakarta, pp. 9-15.

Diacon, D., Pattison, B. and Vine, J. (2010) BSHF Submission to the Spending Review 2010*, Building and Social Housing Foundation 2010*, Leicestershire, pp. 4-7.

Driscoll, D.L., Appiah-Yeboah, A., Salib, P. and Rupert, D.J. (2007) *Merging Qualitative and Quantitative Data in Mixed Methods Research: How To and Why Not*, Ecology and Environment Anthropology, Vol. 3, No. 1.

Duckworth, S. (2004) The Future of Social Housing Is Considered To Be Crucial: Macro-economic framework and social housing finance, Financing system, *UNECE-Conference on Social Housing* in: Europaforum Wien Siegrun Herzog, Johannas Lutter (ed.), Vienna MA 50, p61-62[cited 17th Feb. 2007]. Available from:

http://www.europaforum.or.at/data/media/med_binary/original/1112795352.pdf

Department of Community and Local Government (2006) A Decent Home: Definition and guidance for implementation, *Department of Community and Local Government Publications*, London, pp. 11-19.

Department of Community and Local Government (2007) Impact assessment for homes for the future: more affordable, more sustainable, *Department of Community and Local Government Publications*, London, pp. 16.

Ealing Council (2002) *SP11 Supplementary Planning Guidance for the London Borough of Ealing: Replacement Unitary Development Plan: Affordable Housing*, London, pp. 1-21. http://www.ealing.gov.uk/ealing3/export/sites/ealingweb/services/environment/planning/planning_policy/supplementary_planning_guidance/_docs/11-AffordableHousing.pdf.

Eddie W.L., Cheng and Heng Li (2004) *Construction Innovation*: *A learning culture for strategy partnering in construction* 4: pp. 53-65.

Egan, J. (1998) Rethink Construction (Egan Report), Construction Task Force Report, *Department of the Environment, Transport and the Regions*, London.

Egbu, A.U. (2007) *The Impact of Land Use Planning on Urban Land Market in Sub-Saharan Africa: A case Study of Nigeria,* Unpublished PhD Thesis, School of Engineering and the Built Environment, University of Wolverhampton, UK.

English Heritage (2007) Town Houses Selection Guide: Domestic Building (2), pp. 1-11.

English Partnerships and Housing Corporation (2000) *Urban Design Compendium,* London, Llewelyn-Davies, pp. 1-121.

Farlow, A. (2005) UK House Prices, Consumption and GDP, In A Global Context, Oxford, pp. 1-70. (Accessed on 17/08/2006), available at: http://www.econ.ox.ac.uk/members/andrew.farlow/Farlow%20Housing%20and%20Consumption.pdf.

Fellows, R. and Liu, A. (2003) *Research Methods for Construction 2nd (ed)* Blackwell Science, Oxford.

Fisher, D., Miertschin, S. and Pollock, D.R. (1995) Benchmarking in Construction Industry, *Journal of Management In Engineering,* Vol. 11, No. 1, pp. 50-57.

Fiske, A. P. (1991) *Structures of Social Life: The Four Elementary Forms of Human Relations: Communal Sharing, Authority Ranking, Equality Matching, Market Pricing,* The Free Press, Toronto.

Flynn, B. B., Schroeder, R. G. and Sakakibara, S. (1994) A framework for quality management research and an associated measurement instrument, *Journal of Operations Management*, Vol. 11, pp. 339-66.

Forbus, K.D. (1983) *Qualitative Process Theory*, Massachusetts Institute of Technology, Cambridge, MA,

Ford, D.N., and Sterman, J.D. (1998) Dynamic Modelling of Product Development Processes, *System Dynamic Review*, Vol. 14, No. 1, pp. 31-68.

Freytag, P. and Hollensen, S. (2001) The Process of Benchmarking, Benchlearning and Benchaction, *The TQM Magazine,* Vol. 13, No. 1, pp. 25-33.

Friel, C.M. (2009) Measuring Variability, Criminal Justice Centre, Sam Houston University, pp. 28-30. (accessed on 17/05/2009) at: http://www.shsu.edu/~icc_cmf/cj_685/mod4.doc.

Garbutt, G. (2005) *Delivering A Housing Vision for the West Midlands in the 21st Century: Pathway of Choice*, Birmingham, pp. 212.

Garnett, N. and Pickrell, S. (2000) Benchmarking for construction: theory and practice, *Construction Management and Economics,* Vol. 18, pp. 55-63.

Gibbs, A. and Pendlebury (2005) The off-site project toolkit (C631), *Construction Industry Research and Information Association,*

Glaeser, E. and Gyourko, J. (2003) The Impact of Restrictions on Housing Affordability, *FRBNY Economic Policy Review*, p. 1.

Glaister K.M., and Falshaw, J.R. (1999) Strategic Planning: Still Going Strong?, *Long Range Planning,* Vol.32, No 1, pp. 107-116.

Glaser, B. and Strauss, A (1967) *The discovery of grounded theory.* Chicago: Aldine.

Glasson, J., Therivel, R. and Chadwick, A. (1994) *Introduction to Environmental Impact Assessment,* University College, London, p. 3.

Gosling, L. and Edwards, M. (1995) Toolkit: A practical guide to assessment, monitoring, review and evaluation*, SCF Development Manual*, No. 5., London,

Graham, J., Hoffer, S., Donaldson, S., Mackinnon, D. and Schafer, J. (1995) Analysis with Missing Data in Prevention Research Society of Multivariate Experimental Psychology, *Annual Meeting of the Society of Multivariate Experimental Psychology*, Washington, pp. 325-366.

Gray, C. and Hughes, W. (2001) *Building Design Management*, Butterworth-Heinenmann, Oxford, pp. 101-104.

Griffths, N. (2006) National Affordable Housing Programme 2006/2008: Immediate Analysis, *National Housing Federation*, London.

Guillery, P. (2004) *The Small House In Eighteenth-Century London,* Yale University Press, New Haven, pp. 1-360.

Haig, B. D. (1995) *Grounded Theory as Scientific Method*, Philosophy of Education Society, Canterbury, UK.

Hair, J. F. et al (1995) *Multvariant data analysis with Readings 4th (ed),* Preteice-Hall International, inc., Englewood, New Jersey.

Halifax (2009) House Price Index, (accessed on 13/07/2009), available on: http://www.lloydsbankinggroup.com/media/pdfs/halifax/HousePriceIndexFebruary2009.pdf

Hardi, P. and Pinter, L. (1995) Models and Methods of Measuring Sustainable Development Performance, *International Institute for Sustainable Development*, Manitoba, pp. 1-36.

Harding, A., Enelbrecht, J., Lazenby, K. and Le Roux, I. (2005) Blended learning in Mathematics: Flexibility and Taxonomy in *Handbook of Blended Learning Environments: Global Perspectives,* Local Designs. (eds): Curt Bonk and Charles Graham, Pfeiffer Publishing.

Harding, A., Kaczynski, D. and Wood, L.(2005) Evaluation of Blended Learning: Analysis of Qualitative Data, *Uniserve Science Blended Learning Symposium Proceedings*, pp. 56-62.

Hart, C. (2003) Doing a Literature Review, Sage Publications Ltd., London.

Harvey, A., and Westbury, P. (2007) Housing audit: Assessing the design quality of new housing in the East Midlands, West Midlands and the South West, In J. Birch (Ed.): *Commission for Architecture and the Built Environment*, London.

Helene, M. (2000) Improving the Value of Design: a Quality/Cost Approach, *Proceedings of the sixteenth ARCOM Annual Conference*, University of Reading, Vol.2 pp. 667-674.

Hiley, A. and Gopsill, G. (2000) The implementation of Value Management as a design Management Tool in the UK Construction Industry, *Proceedings of the 16th Annual ARCOM Conference*.

Homes and Communities Agency (2008) *Affordable Housing Survey: A Review of Quality of Affordable Housing in England*, London, pp. 1-28.

Holt, G.D. (1997) ''Construction research questionnaires and attitude measurement: relative index or mean'', *Journal of Construction Procurement*, Vol. 3 No2, pp. 88-96.

Hughes, W. (1989) *Organizational Analysis of Building Projects*, unpublished PhD Thesis, The Polytechnic Liverpool.

Inglis, A. (2008) Approaches to the Validation of Quality Frameworks for e-learning, *Quality Assurance in Education,* Melbourne, Vol. 16 No. 4, pp. 347-362.

Jackson, A. (1970) *The Politics of Architecture: A history of modern architecture in Britain,* Birkenhead, UK.

Janssen, R. (2001) On the Use of Multi-Criteria Analysis in Environmental Impact Assessment in the Netherlands, *Journal of Multi-Criteria Decision Analysis,* Vol. 10, pp. 101-109.

Janssen, R. (1992) Multiobjective Decision Support for Environmental Management, Kluwer Academic Publishers, Dordrecht.

Jones, K. (2000) 'Best Value in Construction' *in:* J. Kelly, R. Morledge, S. Wilkinson (editors), Blackwell Publishing.

Jones, K and Kaluarachichi (2008) Performance measurement and benchmarking of a major innovation programme; *Benchmarking: an international journal*, vol.15, issue 2, pp. 124-136.

Kaka, A.P. (1999) The Development of a Benchmark model that uses historic data for monitoring the progress of current construction projects*, Engineer Construction and Architectural Management,* Vol. 6, No. 3, pp. 257-266.

Kaluarachchi, Y. and Jones, K. (2006) The Relevance of Innovative Environment Technologies In The Sustainable Refurbishment of Social Housing in UK, *World Accelerated Excellence in Built Environment Conference*, Birmingham, pp. 1-9.

Kaplan, R.M. and Sacuzzo, D.P. (1993) Psychological Testing: Principles, *applications issues,* 3rd ed., Brooks Cole, Pacific Grove, CA.

Katz, B., Turner, M., Brown, K., Cunningham, M. and Sawyer, N. (2003) [Online] Rethinking Local Affordable Housing Strategies: Lessons from 70 Years of Policy and Practice, The Brookings Institution Centre on Urban and Metropolitan Policy and The Urban Institute, December 2003, p. vi [cited 28 August 2007]. Accessed via: < http://www.brookings.edu/~/media/Files/rc/reports/2003/12metropolitanpolicy_katz/housingreview.pdf>.

Kelly, J., Morledge, R., & Wilkinson, S. (2002). *Best value in construction*. Oxford, Blackwell Science.

Kemper, E. Stringfield, S. & Teddlie, C. (2003) *Handbook of Mixed Methods in Social & Behavioral Research: Mixed Methods Sampling Strategies in Social Science*

Research In: Tashakkori and Tedddle (eds.), Thousand Oak, CA: Sage, pp. 273-296.

Kempton, J. (2004) Stock Condition Data for Decent Homes: Impact of Surveyors' Judgement, *Structured Survey*, Vol. 22, No. 3, pp. 126-130.

Kiddle, C. (2002) Affordability and Rent Restructuring in the R.S.L. Sector, *HSA Conference*, York, pp. 1-20.

Kim, C. W.; Phipps, T. T. and Anselin, L. (2003) Measuring the benefits of air quality improvement: a spatial hedonic approach*, Journal of Environmental Economics and Management,* pp. 24-39.

Kometa, S.T., Olomolaiye, P.O. and Harris, F.C. (1994) Attribute of UK construction clients influencing project consultants' performance. *Construction Management and Economics*, 12(5), pp. 433-43.

Koning, A. J., and Franses, P. H. (2003) Confidence Intervals for Comparing Cronbach's Coefficient Alpha Values*, Erasmus Research Institute of Management*, Rotterdam, pp. 1-43.

Kusumastu, D. (2002) Development of a Benchmark Model for Irregular Structure, *Ph.D. Dissertation*, Department of Civil, Structural & Environmental Engineering, University at Buffalo, Buffalo, NY, pp. 51-56.

Lee, S., Thomas, S.R. AND Turker, R.L. (2005) Web-Based Benchmarking System for the Construction Industry, *Journal Of Construction Engineering and Management*, Vol. 131, No 7, pp. 790-798.

Lieberman, E.S. (2005) Nested Analysis as a Mixed-Method Strategy for Comparative Research, *American Political Science Review*, Vol. 99, No. 3, pp. 435-452.

Lijphart, A. (1971) Comparative Politics and the Comparative Method, *American Political Science Review* 65 (September): pp. 682-93.

Love, P.E.D. et al. (2001) Construction Managers' Expectations and Observations of Graduates*, Journal of Managerial Psychology*, Vol. 16 No 8, pp. 579-593.

McCabe, S. and Robertson, H. (2000) Striving to Be the Best: A Case Study of Construction Benchmarking World Class Organization*, Sixteenth Annual ARCOM Conference In*: Boyd, D. (Ed), Glasgow, Vol. 1, pp. 355-364.

Milakovich, M.E. (2005) *Improving Service Quality in the Global Economy: Achieving High Performance In Public and Private Sectors.* 2nd ed., Auerbach Publication, pp. 36-43.

Miles, M. B. & Huberman, A. M. (1994) *Qualitative data analysis: An expanded sourcebook (2nd ed.),* Thousand Oaks, California.

Monk, S. *et. al.* (2005) Land and Finance for Affordable Housing: The complementary roles of social Housing Grant and the provision of affordable housing through the planning system*, Joseph Roundtree Foundation*, [cited on 4th September 2008]. Available on: <http://www.jrf.org.uk/bookshop/eBooks/1859353061.pdf>

Morris, E.W., Woods, M.E. and Jacobson, A.L. (1972) The Measurement of Housing Quality.

Moskowitz, H. and Kim, K.J. (1997) QFD OPTIMIZER: A novice quality function deployment decision support system for optimizing product designs, *Computer Industrial Engineering,* vol. 32 No 3, pp. 641-655.

Motwani, J. (2001) Critical factors and performance measure of TQM*, The TQM Magazine*, Vol.13, No. 4, pp. 292-300.

Murie, A. and Walker, B. (2002) Review of Best Value Housing Performance Indicators*, Centre for Urban and Regional Studies, University of Birmingham*, [cited on 12th July 2008]. Available on: <http://www.curs.bham.ac.uk/pdfs/BEST%20VALUE.pdf>

Nabitz, U., Klazinga, N. and Walburg, J. (2000) The EFQM excellence model: European and Dutch experience with the EFQM approach in health care, *International Journal for Quality in Health Care,* Vol. 12, No 3, pp. 191-201.

Nickolson, R. (2006) The cost of bad design: What causes bad design? *Commission for Architecture and the Built Environment*, London, pp. 53-60.

Nijkamp, P. and Van Delft, A.(1977) *Multi-criteria Analysis and Regional Decision Making*, Martinus Nijhoff, Leiden.

NIST/SEMATECH (2006) Engineering Statistic Handbook: *e-Handbook of Statistical Methods*, http://www.itl.nist.gov/898/handbook/.

Norman, K. D. and Yvonna, S.L.(2005) *The Sage Handbook of Qualitative Research*, 3rd edition, California, Thousand Oaks.

Nunnally, J.C. (1988) Psychometric Theory, McGraw-Hill, Englewood Cliffs, NJ.

ODPM (2003) Improving the Delivery of Affordable Housing In London And the South east, *Environmental Resources Management*, (accessed on 4th July 2006), available on http://www.odpm.gov.uk/pub/377/ImprovingtheDeliveryofAffordableHousinginLondonSEFullReportPDF349Kb_id1150377.pdf

Okpala, D.C. and Aniekwu, A.N. (1988) Causes of high costs of construction in Nigeria, *ASCN Journal of construction, engineering and management,* Vol. 114 No. 4, pp. 233-44.

Olomolaiye, P. O., Wahab, K.A. and Price, A.D.F. (1988) Problems influencing craftsmen's productivity in Nigeria*, Building and Environment,* Vol. 22 No. 4, pp. 317-23.

Outhred, G.P. (2001) The Delphi Method: A demonstration of its use for specific research types*,* COBRA 2001, *Proceedings of the RICS Foundation Construction and Building Research Conference*: in Kelly, J. and Hunter, K. (eds), Glasgow, pp. 227-239.

Park, H., Thomas, S.R. and Tucker, R.L. (2005) Benchmarking of Construction Productivity, *Journal of Construction Management,* Vol. 131, No. 7, pp. 772-778.

Parkinson, M., Champion, T., Evans, R., Simmie, J., Turck, I., Crookston, M., Katz, B., Park, A., Berube, A., Coombes, M., Dorling, D. Glass, N., Hutchins, M., Keams, A., Martin, R., and Wood, P. (2006) State *of the English Cities*: O.D.P.M. Research Publication, Vol. 1 and 2, London.

Penn, A. (2008) Architectural Research. *in* Knight, A. and Ruddock, L. (eds.) *Advanced Research Methods in Built Environment.* Chichester-West Sussex, Wiley-Blackwell, pp. 14-27.

Polanyi, K. (1944) *The Great Transformation,* New York, Rinehart.

Proverbs, D. and Gameson, R. (2008) Case Study Research. *in* Knight, A. and Ruddock, L. (eds.), *Advanced Research Methods in Built Environment.* Chichester-West Sussex: Wiley-Blackwell, pp. 99-110.

Ramirez, R.R., Alarcón, L.F.C., and Knight, P. (2004) Benchmarking Systems for Evaluating Management Practices in the Construction Industry, *Journal Of Management In Engineering*, Vol. 20, No.3, pp. 110-117.

Rasmussen, S.E. (1982) *London, the Unique City,* Cambridge, M.I.T. Press.

Reimer, B. (2004) Social Exclusion in a Comparative Context*, European Society for Rural Sociology*, Vol. 44, No. 1, Malden, Blackwell, pp. 76-94.

RIBA (2007) RIBA Response to Housing Green Paper: 'Homes for the future: more affordable, more sustainable.' [Online].[Accessed on 9th December 2007] available at: http://www.architecture.com/Files/RIBAHoldings/PolicyAndInternationalRelations/Policy/PublicAffairs/Housing%20Green%20Paper%20response.pdf

Robinson, H. S., Carrillo, P. M., Anumba, C. J. and Al-Ghassani, A. (2005) Knowledge Management Practices in Large Construction Organisations, *Journal of Engineering, Construction and Architectural Management,* Vol. 12, No. 5, pp. 431-445.

Roche, C. (1999) *Impact Assessment for Development Agencies: Learning to Value Change, Development Guidelines*, Oxford: Oxfam.

Rolinson, J. (2009) Suitable Build: Eco friendly Building Tips & Advice [Online]. [Accessed on: 26/2/2009]. Available at: http://www.sustainablebuild.co.uk/.

Room, G. (1995b) *Beyond the Threshold: The measurement and analysis of social exclusion*, Bristol: Policy Press.

Roush, W.B. and Cravener, T.L. (1992) Choosing A Commercial Laying Hen Strain Based On Multi-criteria Decision Analysis, *Journal of Applied Poultry Research*, pp. 403-409.

Santos, J. R. A. (1999) Cronbach's Alpha: A Tool for Assessing the Reliability of Scales [Online]. *Journal of Extension*, Texas, Vol. 37, No. 2, [Available on 1st April 2009] available at: http://www.joe.org/joe/1999april/tt3.php

Santucci, R. (1995) *Part II:* The Great Production Debate, [Online]. Shelterforce: *National Housing Institute*. [Accessed on 18th February 2008]. Available at: http://www.nhi.org/online/issues/82/debate.html

Saraph, J.V., Benson, G.P. and Schroeder, R.G. (1989) An instrument for measuring the critical factors of quality management, *Design Science*, Vol. 20, pp. 810-29.

Sharp, M. and Jones, K. (2003) Muda in Social Housing Management, In; Proverbs, D. (Ed) *Proceedings of The RICS Foundation Construction and Building Research Conference*, London, pp. 163-173.

Shash, A.A. (1993) ''Factors considered in tendering decisions by top UK contractors''*, Construction Management and Economics*, Vol. 11 No. 2, pp. 111-18.

Sorrell, J., Simmons, R., Desyllas, J., and Nicholson, R., (2006) *The cost of bad design,* London: CABE Research Publication.

Spinnewijn, F. Dandolova, I. and Foster, W. (2004) The Future of Social Housing Is Considered to Be Crucial: Social Cohesion and Social Housing Design, *UNECE-Conference on Social Housing*, Vienna, pp. 28-35.

Stewart, J. (2006) *Building A Crisis: Housing Under-Supply In England,* Home Builders' Federation,

Stroud District Council, (2005) *Equality Impact Assessment*: *Section 106 Planning Contributions Supplementary Planning Document*, pp. 22.

Sureshchander, G.S., Rajendran, C. and Anantharaman, R.N.(2001) A holistic model for total quality service*, International Journal of Service Industry Management*, Vol.12 No 4, pp. 378-412.

Suzemore, S. (2004) Planning & Environmental Law: Protecting Endangered Species: Local Government's Liability, Chicago, vol. 56, No 91.

Svenstrup, M. and Willemann, S. (2006*)* Reforming Housing Finance: Perspectives from Denmark**,** *Journal of Real Estate Research*, Vol. 28, No.2, pp. 105-129.

Symes, M. (1998) The Hulme Design Guide: Sustainability Section [Accessed on 11th February 2009]. Available at: http://research.scpm.salford.ac.uk/bqtoolkit/tkpages/protocol/cases/Doc%2019.htm

Tashakkori and Teddlie (2003) *Handbook of mixed Methods in Social & Behavioral Research,* London: Sage Publications,.

Tam, C. M., Deng, Z.M., Zeng, S.X. and Ho, C.S. (2000) *Quest for Continuous Quality Improvement for Public Housing Construction in Hong Kong***,** Construction Management and Economics, Routledge: Taylor & Francis.

Taylor, D. and Procter, M. (2005) *Writing at the University Of Toronto: The Literature Review, A Few Tips on Conducting It,* Toronto: [Accessed on 25th May, 2006], available on: www.utoronto.ca/writing/litrev.html.

The UK Parliament (2002) *Memorandum by London Borough Tower Hamlets (AFH 22),* Select Committee on Transport, Local Government and the Regions Memoranda [online], London: [Accessed 23 October 2007]. Available at:

http://www.publications.parliament.uk/pa/cm200102/cmselect/cmtlgr/809/809m23.htm.

UK Housing Corporation, (2005) "Guide to Rents Data", Data spring, *The Cambridge Centre for Housing and Planning Research,* [Accessed 21st May, 2006]. Available at: <http://www.dataspring.org.uk/news/tempnews.asp>

UK Housing Corporation, (2006) Affordable Homes Strong Communities: Neighbourhoods and communities strategy, London.

UK Housing Corporation (2007) Affordable Homes Strong Communities: Communities and Countryside Rural housing strategy, London: UK Housing Corporation.

United Nations Economic Commission for Europe (2005) *Social Housing, Governance in Public Private Partnerships for Infrastructure Development Draft,* Calgary, pp. 7.

Venkatramann, N. (1989) ‘‘Strategic orientation of business enterprises: the construct, dimensionality and measurement’’, *Management Science*, Vol. 35 No. 8, pp. 942-62.

Voogd, H. (1983) *Multi-criteria Evaluation for Urban and Regional Planning*, London: Pion.

Walsall Council (2010) *Section 106 Agreement: Securing Community Benefits through a Planning Obligation* [online]. Walsall: Planning and Building Control. Updated 25th January 2010 [Accessed 30th January 2010]. Available at <http://www.walsall.gov.uk/section_106_agreements.htm>.

Walsh, C. (2002) *Construction Related Sustainability Performance Indicator: Theory, methodology & initial application*, Dublin, pp. 5-7.

World Architecture News.com (2009) *The Global Resource for Architecture, Affordable Housing Innovations:* in Young N.M. (ed.), [Accessed on 26th February,2009].Available at:http://www.worldarchitecturenews.com/index.php?fuseaction=wanappln.projectview&upload_id=11006.

Watcher, S. (2006) *Project Book- A Design-Focused Work Book to Accompany the Affordable Housing Design Advisor*, Boston: U.S. Department Of Housing And Urban Development, pp. 126.

Willemsoen, T.; Jacobs, M.; Vossen, A.; and Frinkin, G. (2001) *An Impact Assessment of Policy Measures to Influence the Gender Division of Work*, London: 7:3, pp. 369-386.

Wilson, W. and Anseau, J. (2006) *Research Paper 06/41: Affordable Housing in England*, London: House of Commons Library, pp. 4-10.

Yasin, M. (2002) The Theory and Practice of Benchmarking: Then and Now, *Benchmarking: An International Journal*, Vol.9, No. 3, pp. 217-243.

Yorkshire and Humber Assembly (2005) *Yorkshire and the Humber Regional Housing Strategy 2005-2021,* Leeds, pp. 34-36, (Accessed on 26 May, 2008), available at: http://www.yhassembly.gov.uk/dnlds/Regional%20Housing%20Strategy%202005-11.p.

LIST OF APPENDICES

APPENDIX-1

IDENTIFIED AFFORDABLE HOUSING SCHEMES IN ENGLAND

	AFFORDABLE HOUSING SCHE	DEVELOPER/ ARCHITECT	CATEGORY	CRITERIA / PARAMETERS/(K.P
1	**Nature Conservation, Middlesbrough, TS1 1EL, Cleveland, UK**	o Middleborough Environmental City, Middlebrough Council	UNHABITAT Best Practice:	**Housing** o Affordable Housing o Construction Industry Poverty Eradication o Vocational Training Civil Engagement and Cultural Vitality o Reduction Of Exclusion o Social Integration
2	**Women And Accessibility In Town Centres: Open Sesame Project, Somerford Grove, Tottenham, N17** London, UK	o Northumberland Women and Children Centre. o London Borough of Haringey. o Department of Planning, University of England	UNHABITAT Best Practice: Good Practice	**Housing** o Affordable Housing Social Housing o Crime Reduction and Prevention o Public Safety
3	**Changing Travel Behaviour and Public Attitudes to Transport, Winchester, Hampshire, SO23 8VE, UK**	o Headstart Community Advisory Panel. o Ciaburro Tony Head Transport Planning. o Hampshire County Council	UNHABITAT Best Practice: Good Practice	**Housing** o Affordable Housing Social Services o Crime Reduction and Prevention o Public Safety Environmental Management o Environmental Health o Urban Greening
4	**Manningham Housing Association, West Yorkshire, BD1 3ED,** UK	o Manning Housing Association. o Singh Anil o Local Authority	UNHABITAT Best Practice: Good Practice	**Urban Governance** o Public Administration and Management. Urban And Regional Planning. o Community-based Planning Environmental Management o Environmental Health o Pollution Reduction
*5	**Affordable Housing In Rolls Crescent, Hulme, Manchester, UK**	o Manchester City Council o Hulme Regeneration Limited. o North British	UNHABIAT Best Practice: Good Practice	**Housing** o Affordable Housing Social Services o Crime reduction/prevention; public safety
*6	**CASPAR I (City-Centre Apartments for Single People at Affordable Rents), Birmingham, UK**	o Allford Hall Monaghan Morris Architects	CABE Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
*7	**Park Central Zone 1, Bath Row, Birmingham, B15 1NZ, UK**	o Crest Nicholson PLC, Crest House, 39 Thames Street, Weybridge, Surrey KT13 8JL, UK	CABE: Building For Life ward Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
8	**Affordable Housing Poundbury, Dorchester, West Dorset, UK**			

9	**Affordable Housing Canning Street, Liverpool, UK**			
10	**Affordable Housing In Eastern Quarry, Kent Thameside London, UK**			
11	**Affordable Housing In Highset, Cambridge UK**			
12	**Affordable Housing In Jesmond, Newcastle, UK**			
13	**Affordable Housing In Friar Quay, Norwich, UK**			
14	**Affordable Housing In Thorley Lane, Bishop Stortford, East London, UK**			
15	**Affordable Housing In Greenland Passage, Southwark, London, UK**			
16	**Affordable Housing In Isledon Village, Islington, London**, UK			

17	**Affordable Housing In Deansgate Quay, Manchester, UK**			
18	**Affordable Housing In Webster's Yard, Kendal, UK.**			
19	**Affordable Housing In Beaufort Court, Lille Road, Fulham, London, UK**	**Developer** o Peabody Trust; **Architects** o Fielden Clegg Bradley Architects; **Landscape Architect** o Grant Associates; **Sub-Contractors** o The Forge Company **M.& E.E.** o Max Fordham LLP **Planning Authority** o London Borough of Hammersmith and Fulham	CABE 2003 Gold Award for Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
20	**Affordable Housing In Lord Street, Gravesend, UK**			
21	**Affordable Housing In Irk Valley, Manchester, UK**			
22	**Affordable Housing In Bookbinders Court, Oxford, UK**			
23	**Affordable Housing In Point Pleasant, London, UK**			

24	**Affordable Housing In Beaufighter Road, West Malling, UK**			
25	**Affordable Housing In Oak Meadow, South Molton, Devon, UK**		Schemes Development Standard(SDS)	
26	**Affordable Housing In Elizabeth Jennings Way, Oxford, UK**			
27	**Affordable Housing In Oakridge Village, Basingstoke, UK**			
28	**Affordable Housing In Rivermead Park, Oxford, UK**			
29	**Affordable Housing In Chapel Southampton, UK**	**Developers** o Swaythling Housing Society; Persimmon Homes; **Architect** o Chetwood Associates **Planning Authority** o Southampton City Council; **Structural Engineer** o Garry Gable Associates ; **Building Services** o King Shaw Associates **Civil/ Traffic Consultant** o Mott Macdonald	CABE 2005 Gold Award for Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
30	**Affordable Housing, Faith House, Holton Lee, Dorset, UK**		CABE Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community

31	**Affordable Housing, Glaxo Wellcome House West, Greenford, UK**		CABE Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
32	**Loxley House for Capital One, Nottingham, UK**		CABE Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
33	**Affordable Housing, Bishop Walk Ely, Cambridgeshire, UK**		CABE: Building For Life Award Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
34	**Affordable Housing, Horsebridge Development Whitstable, UK**	o Banbury Estate – Developer, The Courtenay Trust	CABE: Building For Life Award Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
35	**Affordable Housing, Gainsborough Studio, London, UK**	**Architect** o Munkenbeck & Marshall; **Developer** o Southern Housing Group; **Planning Authority** o London Borough of Hackney; o Gillees LLP; **Developer** o Lincoln Holdings Plc	CABE: Building For Life Award Benchmark Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community
36	**Affordable Housing, Stansted Road, Lewishan, London, UK**			
37	**Affordable Housing, Abode Newhall, Harlow, UK**	**Architects** o Procter Mathews **Developer** o Copthorn Homes **Master Planners** o Roger Evans Associates **Structural Engineer** o Cameron Taylor Bedford	CABE 2003 Gold A Building for Life Be Affordable Housing	**Character** o Roads, Parking and Pedestrian o Design and Construction o Environment and Community

38	**Affordable Housing Scheme, 68-72 Redchurch Street, E1, London**	**Architect** o Thinking Space Ltd **Developer** o Swanage Ltd **Planning Authority** o London Borough of Tower Hamlet		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
39	**Affordable Housing Scheme, Benyon Wharf, E8, London**	**Architect** o JCMT Architects **Developer** o Investland Group Ltd **Planning Authority** o London Borough of Hakney		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
40	**Affordable Housing Scheme, Broadclose (Phase 1), Cornwall**	**Architect** o Trewin Design Partnership **Developer** o Guiness Trust **Planning Authority** o North Cornwall District Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
41	**Affordable Housing, Brooks Road, E13, London**	**Architect** o Bell Phillips Architects **Developer** o London Borough of Newham Housing Project Team **Planning Authority** o London Borough of Newham		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship

42	**Affordable Housing Scheme, Colony Mews, N1, London**	**Architect** o Peter Barber Architects **Developer** o Colony Development Ltd **Planning Authority** o London Borough of Islington		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
43	**Affordable Housing Scheme, Edge Apartments, Middlesex**	**Architect** o Quad Architects **Developer** o Quad Projects **Planning Authority** o London Borough of Richmond Upon Thames		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
44	**Affordable Housing, Glen Eyre Student Residences, Southampton**	**Architect** o Jestico+Whiles **Developer** o University of Southampton **Planning Authority** o Southampton City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
45	**Affordable Housing, Gray's Inn Buildings, EC1R, London**	**Architect** o Jestico+Whiles **Developer** o Community Housing Group **Planning Authority** o London Borough Canden		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship

46	**Affordable Housing, Guest Street Housing, Manchester**	**Architect** o De Metz Forbes Knight **Developer** o Great Places Housing Group **Planning Authority** o Manchester City Council	SDS Standard	o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction Finishing, detailing and workmanship
47	**Affordable Housing, Gun Wharf, Devon**	**Architect** o Lacey Hickie Caley Architects **Developer** o Davon & Cornwall Housing Assoiation **Planning Authority** o Plymouth City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
48	**Affordable Housing, Islington Square Manchester**	**Architect** o Fashion Architecture Taste **Developer** o Manchester Methodist **Planning Authority** o Manchester City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
49	**Affordable Housing, Jubilee Wharf, Cornwall**	**Architect** o Bda ZEDfactory Ltd **Developer** o Robotmother Ltd **Planning Authority** o Carrick District Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
50	**Affordable Housing, Kleine Wharf, N1, London**	**Architect** o Pollard Thomas Edwards Architect **Developer** o Places For People **Planning Authority**		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and

		o London Borough of Hackney		footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
51	**Affordable Housing, Melody Lane, N5, London**	**Architect** o Julian Cowie Architect **Developer** o London Wharf PLC **Planning Authority** o London Boriugh Of Islington		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
52	**Affordable Housing, Selwyn Close, Oldham**	**Architect** o TADW Architects **Developer** o Manchester Methodist Housing (part of Great Places Housing Group) **Planning Authority** o Oldham Metropolitan Borough Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
53	**Affordable Housing, Skyline Central, Manchester**	**Architect** o Jacobs Webber **Developer** o West Properties **Planning Authority** o Manchester City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
54	**Affordable Housing, Tachbrook Triangle, SW1V, London**	**Architect** o Assael Architecture **Developer** o Barret West London **Planning Authority** o West Minister Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning

				o Sustainability in construction o Finishing, detailing and workmanship
55	**Affordable Housing, Tanner Street Gateway, Barking**	**Architect** o Peter Barber Architects **Developer** o East Thames Housing Association **Planning Authority** o London Borough Of Barking & Dagenham		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
56	**Affordable Housing, The Brookland, NW1, London**	**Architect** o Mark Fairhust **Developer** o Q Developments **Planning Authority** o Westminster City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
57	**Affordable Housing, The Manor House Estate, Suffolk**	**Architect** o Mullins Dowse & Partners **Developer** o Manor House Estate(Bawdsey) Ltd **Planning Authority** o Suffolk Coastal District		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
58	**Affordable Housing, The Sinclair Building, Sheffield**	**Architect** o Project Orange Architects **Developer** o Sinclairs **Planning Authority** o Sheffield City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction

				o Finishing, detailing and workmanship
59	**Affordable Housing, Unity Building, Liverpool**	**Architects** o Allford Hall Monaghan Morris LLP **Developers** o Rumford Investments **Planning Authority** o Liverpool City Council		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
60	**Affordable Housing, Westway Beacons, W12, London**	**Architects** o Gardner Stewart **Developers** o London and Quadrant Housing Trust **Planning Authority** o London Borough of Hammersmith & Fulham		o Relationship to surrounding neighbourhood o Response to site constraints and opportunities o Layout, grouping and landscaping o Planning of roads and footpaths o Handling of garages and car parking o Attention to safety, security and accessibility o External appearance and internal planning o Sustainability in construction o Finishing, detailing and workmanship
61	**Affordable Housing, Angell Town, London**		SDS Standard	
62	**Affordable Housing, Attwood Green, Birmingham**		SDS Standard	
63	**Affordable Housing, Bevendeean, Brighton**		SDS Standard	

64	**Affordable Housing, Boulevard, Holborough Valley**		SDS Standard	
65	**Affordable Housing, Brooklands Avenue, Cambridge**		SDS Standard	
66	**Affordable Housing, Colliers Garden**		SDS Standard	
67	**Affordable Housing, Francis Court, Halesowen**		SDS Standard	
68	**Affordable Housing, Linden Lea, Down Ampney, Gloucestershire**		SDS Standard	
69	**Affordable Housing, Mealhouse Brow, Stockport**		SDS Standard	
70	**Affordable Housing, Oaklands Court, London**		SDS Standard	
71	**Affordable Housing, Parkside Court, Stockton**		SDS Standard	

72	**Affordable Housing, Pepys Estate, London**		SDS Standard	
*73	**Affordable Housing, Sherrydon, Cranleigh**	**Developer** o Pavillion		
*74	**Affordable Housing, Grove Road, Hindhead**	**Developer** o A2		
75	**Affordable Housing, Admiral Way, Godalming**	**Developer** o Mount Green		
76	**Affordable Housing, Midhurst, Haslemere**	**Developer** o Pavillion		
77	**Affordable Housing, Dorkote, Witley**	**Developer** o Thames Valley Housing Association		
78	**Affordable Housing, Queensmead, Chuddingfold**	**Developer** o English Rural Housing Association		
79	**Affordable Housing, Royal British Legion site, Dunsfold**	**Developer** o English Rural Housing Association		

80	**Affordable Housing, Farnham Hospital, Farnham**	**Developer** o English Rural Housing Association		
*81	**Affordable Housing, Leeman Road , York**			
*82	**Affordable Housing, Rawcliffe Grange, York**			
*83	**Affordable Housing, Old Apple Store, Stawell, Somerset**			
*84	**Affordable Housing, North Allington Road, Bridgeport, Dorset**			

APPENDIX -2

PILOT STUDY SURVEY QUESTIONNAIRE

PILOT STUDY

DEVELOPMENT OF BENCHMARK FOR IMPACT ASSESSMENT OF AFFORDABLE HOUSING IN ENGLAND

Introduction

The continued demand for decent Affordable Homes in England; development of new strategies for delivery of these Homes; and consideration for better ways of integrating the supply chain are drivers for research in the area of Affordable Housing quality advancement.

A national survey is being conducted by West Midlands Centre for Constructing Excellence and The University of Wolverhampton for development of collaborative strategy for measuring and improving the quality of Affordable Homes in England.

Please kindly indicate if you want to be part of the national survey?

☐Yes ☐No

If yes, please provide your contact details.

Name ……
Address……
……
Tel……E-mail……

Please kindly describe your role in the Affordable Housing supply chain:-

☐Architects ☐Engineers

☐Planners ☐Builders

☐Contractors ☐Sub-Contractors

☐Local Authorities ☐Registered Social Landlords;

☐Housing Associations ☐Estate Surveyors

☐Private Landlords ☐Charitable Organisations

☐Religious Organisation ☐Mortgage Institutions

☐ Tenants ☐ Owner Occupiers

☐Others (Please Specify)……..

Embassy House (5th Floor), 60 Church Street, B3 2DJ, Birmingham, UK . Tel: 0121 688 4050
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APPENDIX -3

DEVELOPERS' QUESTIONNAIRE SCHEDULE

QUESTIONNAIRE

WEST MIDLANDS CENTRE FOR CONSTRUCTING EXCELLENCE,
SCHOOL OF ENGINEERING AND THE BUILT ENVIRONMENT,
UNIVERSITY OF WOLVERHAMPTON WV1 1SB,
WOLVERHAMPTON, UK
TEL: 01902321271
E-MAIL: nellok@wmcce.org

DEVELOPMENT OF BENCHMARK FOR IMPACT ASSESSMENT OF AFFORDABLE HOUSING IN UK

Dear Potential Participant,

We at the University of Wolverhampton are carrying out a study leading to assessment of (economical, sociological, technological and environmental) impacts on the quality of Affordable Housing delivery in UK. Part of this study is to solicit your views concerning the development of Affordable Housing in UK.

As one of the global stakeholders in the development of Affordable Housing in UK, I would like to invite you to participate in the above research project.

The research partly involves capturing your views through the attached questionnaire that we hope will not take much of your time. If results of this study are published, they will be a summary of all responses from all respondents to ensure that your privacy is protected.

Many thanks,
Nelson Okehielem

GENERAL QUESTIONNAIRE SCHEDULE

Please kindly complete this Questionnaire based on the following definitions:

''**Affordable Housing** includes social-rented housing and other forms of sub-market housing (known as intermediate housing). Social-rented housing is housing at social rents (i.e. subject to the rent restructuring regime) and accessed via local authority or RSL housing registers. Other forms of sub-market housing include forms of low-cost home ownership such as shared ownership and Home buy and housing available at intermediate rents (above social rent but below market rent)''

(Wilson, W. and Anseau, J. (2006) *Research Paper 06/41: Affordable Housing in England*, House of Commons Library, London, pg 4-10).

Quality is defined in this research as all the attributes by which Affordable Housing is measured. These include: design; built; innovative; socio-economic; cost saving; and environmental attributes.

INSTRUCTIONS

Kindly indicate all answers by ticking (x) in any box or cell attached to the option that best describe your opinion in each question.

SECTION (A).GENERAL BACKGROUND

1)To which of the following supply chain categories do you belong? Please tick any of the boxes below.

☐ Architects ☐ Engineers ☐ Planners ☐ Builders

☐ Contractors ☐ Sub-Contractors ☐ Developers ☐ Others (Please Specify)

2) In which region(s) of England are most of your Affordable Housing projects located? Please tick any of the boxes below.

☐ North East ☐ North West ☐ London ☐ West Midlands

☐ East Midland ☐ South East ☐ South West ☐ Yorkshire and Humber

☐ East of England ☐ None ☐ Outside England (Please Specify)

3) How many years have you been personally involved in the delivery of each category of housing? Please tick one cell in each of the cases below.

BUILDING CATEGORY	None	1-5Yea	6-15Ye	Over15Yea
Affordable Housing Projects	☐	☐	☐	☐
Other Market Housing Projects	☐	☐	☐	☐

4) How many affordable housing schemes have you been involved in since the last 3 years? Please tick one of the boxes below.

☐ **No Schemes** ☐ **1-3 Schemes** ☐ **4-8 Schemes** ☐ **9-12 Schemes**

☐ **Over 12 Schemes**

SECTION (B) USE OF SPACES, MATERIALS AND FORMS IN DESIGN

5) Please rank the sub-parameters below in order of preference for achieving high quality Affordable Housing, starting from 1st (the highest) to 10th (the least)? Kindly tick one cell among the ranks for each sub-parameter avoiding repeat of any rank.

SUB-PARAMETER	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Ease of access between Housing units and neighbourhood	☐	☐	☐	☐	☐	☐	☐	☐	☐
Space Management and relationship	☐	☐	☐	☐	☐	☐	☐	☐	☐
Consideration for Usage/function	☐	☐	☐	☐	☐	☐	☐	☐	☐
Performance of the structure	☐	☐	☐	☐	☐	☐	☐	☐	☐
Provision Engineering Services/Utilities	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction Methods for delivery	☐	☐	☐	☐	☐	☐	☐	☐	☐
Architectural Forms/materials application	☐	☐	☐	☐	☐	☐	☐	☐	☐
Character/Innovation of the Scheme	☐	☐	☐	☐	☐	☐	☐	☐	☐
Environment/Community	☐	☐	☐	☐	☐	☐	☐	☐	☐
Layout Planning	☐	☐	☐	☐	☐	☐	☐	☐	☐

6) Which materials do you prefer using while developing various components of high quality Affordable Homes? Please tick one or more cells (as applicable).

BUILDING SUB-SYSTEM / BUILDING MATERIALS	Masonry	Gypsum	Polymer Based Product (Plastics/PVC)	Metal	Glass	Timbre	Slate	Concrete	Others(Please Specify)
Foundation	☐	☐	☐	☐	☐	☐	☐	☐	☐
Floors	☐	☐	☐	☐	☐	☐	☐	☐	☐
Walls	☐	☐	☐	☐	☐	☐	☐	☐	☐
Doors	☐	☐	☐	☐	☐	☐	☐	☐	☐
Windows	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ceiling	☐	☐	☐	☐	☐	☐	☐	☐	☐
Roof Cladding	☐	☐	☐	☐	☐	☐	☐	☐	☐

SECTION (C) HOUSING CONSTRUCTION AND REFURBISHMENT

7) Please indicate the ratio between refurbished and new build Affordable housing that you were involved in the last 3 years? Please tick one cell in each of the cases below.

BUILDING CATEGORY	(0-20)%	(21-40)%	(41-59)%	(60-79)%	(80-100)%
New Build Affordable Housing	☐	☐	☐	☐	☐
Refurbished Affordable Housing	☐	☐	☐	☐	☐

8) Which of these building systems (processes) have you applied to enhance Affordable Housing quality? Please tick all are applicable below.

Traditional System of building	☐
Volumetric System of building	☐
Panellised System of building	☐
Pod (Bathroom/Kitchen)	☐
Light Weight Cladding	☐
Hybrid System of building	☐
Sub-assemblies and components System of building	☐
Others (Please Specify)…	☐

9) Please indicate the level of impact that each of the following factors have in the selection of building materials for high quality Affordable Homes. Kindly tick one cell for each factor.

FACTORS	No Opinion	Low Impact	Average Impact	High Impact	Highest Impact
Construction System	☐	☐	☐	☐	☐
Funding	☐	☐	☐	☐	☐
Government Policy On Quality	☐	☐	☐	☐	☐
Material Specification	☐	☐	☐	☐	☐
Design of the Structure	☐	☐	☐	☐	☐
Location of the Scheme from material source	☐	☐	☐	☐	☐
Technique for application	☐	☐	☐	☐	☐
Legislation enhancing usage	☐	☐	☐	☐	☐
Standards in use	☐	☐	☐	☐	☐
Planning regulations	☐	☐	☐	☐	☐
Others (Please Specify)	☐	☐	☐	☐	☐

10) Please indicate the level of impact of the following factors on the quality of Affordable Housing you developed in the last 3 years. Kindly tick one cell among the options for each factor below.

FACTORS	No Opinion	Low Impact	Average Impact	High Impact	Highest Impact
Cost Effectiveness	☐	☐	☐	☐	☐
Durability of the Structure	☐	☐	☐	☐	☐
High Strength of the Framework	☐	☐	☐	☐	☐
Ease of procurement of the building materials	☐	☐	☐	☐	☐
Compatibility with Climate	☐	☐	☐	☐	☐
Ease of Application of Building Techniques	☐	☐	☐	☐	☐
Others (Please specify)	☐	☐	☐	☐	☐

11) How long do you expect your best quality New Build Affordable Housing to last? Please tick any of the boxes attached to your opinion below.

☐ 1-25 years ☐ 26-50 years ☐ 51-75 years ☐ 76-100 years ☐ Above 100 years

12) To what extent do you agree that a prolonged defect liability period will enhance the quality of Affordable Homes? Please tick one of the boxes attached to your opinion below.

☐ Neutral/No opinion ☐ Strongly Disagree ☐ Disagree ☐ Agree ☐ Strongly Agree

SECTION (D) APPLICATION OF HOUSING TOOLKITS AND INNOVATIVE IDEAS

13) These housing toolkits are essential in improving the quality of Affordable homes. Please state your level of agreement with this statement. Kindly tick one cell among the options for each Housing Toolkit below.

HOUSING TOOLKITS	No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree
Design Quality Indicators	☐	☐	☐	☐	☐
Housing Quality Indicators	☐	☐	☐	☐	☐
Best Value Performance Indicators	☐	☐	☐	☐	☐
Strategic Forum Integration Toolkit	☐	☐	☐	☐	☐
Affordable Housing Toolkit	☐	☐	☐	☐	☐
Fiscal Impact Assessment Model	☐	☐	☐	☐	☐
Off-site Project Toolkit	☐	☐	☐	☐	☐
CIRIA (CDAPT) Toolkit	☐	☐	☐	☐	☐
Community Land Trust (CLT) Toolkit	☐	☐	☐	☐	☐
Others (Please Specify)	☐	☐	☐	☐	☐

14) To improve on the quality of Affordable Housing, please rank in order of preference from 1st (highest) to 8th (lowest). Kindly tick only a cell for each component of quality avoiding repeat of any rank.

COMPONENTS OF QUALITY	1st	2nd	3rd	4th	5th	6th	7th
Design	☐	☐	☐	☐	☐	☐	☐
Planning	☐	☐	☐	☐	☐	☐	☐
Construction Technology/Process	☐	☐	☐	☐	☐	☐	☐
Cost effectiveness	☐	☐	☐	☐	☐	☐	☐
Technological Innovation	☐	☐	☐	☐	☐	☐	☐
Employment generation	☐	☐	☐	☐	☐	☐	☐
Environmental Quality	☐	☐	☐	☐	☐	☐	☐
Maintainability	☐	☐	☐	☐	☐	☐	☐

15) Please rate the impact level of these quality standards on our Affordable Housing in the last 3 years? Kindly tick among the options for each quality standard below.

QUALITY STANDARDS	No Opinion	Low Impact	Average Impact	High Impact	Highest Impact
Schemes Development Standards	☐	☐	☐	☐	☐
ECOHOMES Standard	☐	☐	☐	☐	☐
Decent Homes Criteria	☐	☐	☐	☐	☐
Sustainable Homes Standard	☐	☐	☐	☐	☐
UNHABITAT Best Practice Standard	☐	☐	☐	☐	☐
CABE Build for Life Standard	☐	☐	☐	☐	☐
BRHG Best Practice Standard	☐	☐	☐	☐	☐
Others (Please Specify)	☐	☐	☐	☐	☐

SECTION (E) LEVEL OF COST REDUCTION ACHIEVED

16) Please estimate to what percentage each of these factors contributed in reducing cost of living in your last Affordable Housing scheme. Kindly tick one cell among the options for each factor below.

FACTORS	0%/No Opinion	1-10%	11-20%	21-30%	Over30%
Energy Resources/Supply	☐	☐	☐	☐	☐
Control of Emissions	☐	☐	☐	☐	☐
Water Resources/Supply	☐	☐	☐	☐	☐
Construction/Refurbishment	☐	☐	☐	☐	☐
Usage and Maintenance	☐	☐	☐	☐	☐
Materials Resources/Supply	☐	☐	☐	☐	☐
Building Materials Processing	☐	☐	☐	☐	☐
Waste Management	☐	☐	☐	☐	☐
Demolition/Deposition/Recycling	☐	☐	☐	☐	☐
Others (Please Specify)	☐	☐	☐	☐	☐

17) Do you agree that (1 bed 2-person Affordable Housing unit) can be achieved on a 46sq m plot with £60,000 without negative impact on its quality? Please tick from 1(Disagree)-5(Agree) in the boxes below.

☐ Neutral/No opinion ☐ Strongly Disagree ☐ Disagree ☐ Agree ☐ Strongly Agree

SECTION (F) SOCIO-ECONOMICAL BENEFITS EXPECTED OF AFFORDABLE HOMES

18) Please indicate the level of impacts of these factors on the quality of your last Affordable Housing project? Kindly tick one cell in each case below from (No Opinion) to (Highest Impact).

SOCIO-ECONOMICAL FACTORS	No Opinion	Low Impact	Average Impact	High Impact	Highest Impact
Reduction of Security/Crime	☐	☐	☐	☐	☐
Cost of Living	☐	☐	☐	☐	☐
Social Cohesion	☐	☐	☐	☐	☐
Social Equality and Inclusion	☐	☐	☐	☐	☐
Humanitarian Support	☐	☐	☐	☐	☐
Employment	☐	☐	☐	☐	☐
Transportation	☐	☐	☐	☐	☐
Others (Please Specify)	☐	☐	☐	☐	☐

SECTION (G) INTEGRATION OF AFFORDABLE HOUSING WITHIN ITS ENVIRONMENT

19) Please estimate the proximity of these support facilities to the dwelling units of your last Affordable housing tick one cell in each row provided below.

HOUSING SUPPORT FACILITIES	No Opinion	(100-200) meters	(300-400) meters	(400600) meters	(400-800) meters	(600-800) meters	(800-1000) meters	(1000-1500) meters	(1500-2000) meters	(2000-5000) meters	5000 meters
Toddlers Play Area	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Allotment/ Community Garden	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bus Stop	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Primary School	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pub/Club	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Railway Station	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Playing Fields	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Park or Open Space	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Health Centre	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Secondary school Open Access	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Main Natural Green Space	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cultural and Entertainment Facilities	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Major Commercial Centre	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
General Hospital	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Any other Comments

If you would like to have access to the report please fill-in your name, position, role, e-mail address and institutional affiliation/or address below:
OPTIONAL
Name
Position
Role
E-mail address
Institutional affiliation/or address

Thank you for participating in this Research

Please return completed questionnaire not later than 16th October , 2008 either by e-mail or post to:

Nelson Okehielem,
West Midlands Centre for Constructing Excellence,
School of Engineering and Built Environment,
University of Wolverhampton,
WV1 1SB,
Tel: (44)1902321271, (44)7896708476.
E-mail: nellok@wmcce.org.

APPENDIX -4

QUANTITATIVE CODE BOOK OF DATA COLLECTED FROM QUESTIONNAIRE

INDICATORS	QUESTION No	NAME/CODING	LABEL (PARAMETERS)	IMPACT FACTORS	MEAN	Relative Importance Index			
						Technological Impact	Economical Iimpact	Environmental Impact	Sociological Impact
DQI	5 (1)	DSubPAcc	Design Sub-parameter 1	T					
	5 (2)	DSubPSp	Design Sub-parameter 2	T					
	5 (3)	DSubPUs	Design Sub-parameter 3	T					
	5 (4)	DSubPPer	Design Sub-parameter 4	T					
	5 (5)	DSubPEn	Design Sub-parameter 5	T					
	5 (7)	DSubPArc1	Design Sub-parameter 7	T					
	5 (8)	DSubPCh	Design Sub-parameter 8	T					
	5 (9)	DSubPEv	Design Sub-parameter 9	S;Ev					
	5 (10)	DSubPLy	Design Sub-parameter 10	T					
	9 (5)	BMSIDsg	Building Materials Specification Impact 5	T					
	9 (10)	BMSIPlrg	Building Materials Specification Impact10	T;Ev					
	10)	IFCcli	Impact Factor 5	T;Ev					
	13 (1)	HTDQI1	Housing Toolkit 1	T					
	14 (1)	QCD	Quality Component 1	T;Ev		**T**	**E**	**Ev**	**S**
	14 (2)	QCPln	Quality Component 2	T;Ev		3.14	0	3.8	5
					3.4				
BQI	5 (6)	DSubPCnst	Design Sub-parameter 6	T					
	5 (7)	DSubPArc2	Design Sub-parameter 7	T					
	7 (1)	NBAH	New Build Affordable Housin	T					
	7 (2)	RAH	Refurbished Affordable Hous	T					
	8 (1)	BPTrd	Building Process 1	T					
	8 (2)	BPVol	Building Process 2	T					
	8 (3)	BPPnll	Building Process 3	T					
	8 (4)	BPPd	Building Process 4	T					
	8 (5)	BPLWCld	Building Process 5	T					
	8 (6)	BPHbd	Building Process 6	T					
	8 (7)	BPSass	Building Process 7	T					
	9 (1)	BMSICtnsy	Building Materials Specification Impact 1	T					
	9 (4)	BMSIMat	Building Materials Specification Impact 4	T;Ev					
	9 (7)	BMSITch1	Building Materials Specification Impact 7	T					
	9 (9)	BMSIStus	Building Materials Specification Impact 9	T					
	10 (2)	IFDurbty	Impact Factor 2	T					
	10 (3)	IFHStrgt	Impact Factor 3	T					
	10 (6)	IFAppl1	Impact Factor 6	T					
	11	BQNBLfC	Best Quality New Build Life Circle	T					
	12	BDLP	Building Defect Liability Peric	T					
	13 (2)	HTHQI1	Housing Toolkit 2	T					
	13 (7)	HTOPT1	Housing Toolkit 7	T					
	14 (3)	QCCTP	Quality Component 3	T					

	14 (8)	QCMgbty	Quality Component 8	T		**T**	**E**	**Ev**	**S**
	16 (7)	CRFBdgM	Cost Reduction Factor 7	T;E	**BQI**	2.96	1	4	0
					2.94				
INVQ	9 (7)	BMSITch2	Building Materials Specification Impact 7	T					
	10 (6)	IFAppl2	Impact Factor 6	T					
	13 (1)	HTDQI2	Housing Toolkit 1	T					
	13 (2)	HTHQI2	Housing Toolkit 2	T					
	13 (3)	HTBVPI	Housing Toolkit 3	T					
	13 (4)	HTSFIT	Housing Toolkit 4	T					
	13 (5)	HTAHT	Housing Toolkit 5	T					
	13 (6)	HTFIAM	Housing Toolkit 6	T					
	13 (7)	HTOPT2	Housing Toolkit 7	T					
	13 (8)	HTCDAPT	Housing Toolkit 8	T					
	13 (9)	HTCLTT	Housing Toolkit 9	T					
	14 (5)	QCTinnv	Quality Component 5	T					
	16 (1)	CRFEnR1	Cost Reduction Factor 1	T;E					
	16 (2)	CRFCtrE2	Cost Reduction Factor 2	T;E					
	16 (3)	CRFWRs1	Cost Reduction Factor 3	T;E					
	16 (4)	CRFCntRf1	Cost Reduction Factor 4	T;E					
	16 (7)	CRFBlgM2	Cost Reduction Factor 7	T;E					
	16 (8)	CRFWstMg1	Cost Reduction Factor 8	T;E		**T**	**E**	**Ev**	**S**
	16 (9)	CRFDmDR1	Cost Reduction Factor 9	T;E		1.84	1.29	0	0
					1.69				
CSQ	9 (2)	BMSIFdg	Building Materials Specification Impact 2	E					
	10 (6)	IFCst	Impact Factor 1	T					
	14 (4)	QCCEff	Quality Component 4	E					
	16 (1)	CRFEnR2	Cost Reduction Factor 1	T;E					
	16 (2)	CRFCtrE3	Cost Reduction Factor 2	T;E					
	16 (3)	CRFWRs2	Cost Reduction Factor 3	T;E					
	16 (4)	CRFCntRf2	Cost Reduction Factor 4	T;E					
	16 (5)	CRFUsMt	Cost Reduction Factor 5	T;E					
	16 (6)	CRFMtRs	Cost Reduction Factor 6	T;E					
	16 (7)	CRFBlgM3	Cost Reduction Factor 7	T;E					
	16 (8)	CRFWstMg2	Cost Reduction Factor 8	T;E					
	16 (9)	CRFDmDR2	Cost Reduction Factor 9	T;E	**CSQ**	**T**	**E**	**Ev**	**S**
	18 (2)	SEFCsLiv1	Socio-economical Factor 2	E;S		1.6	1.73	0	0
					1.87				
SEQ	14 (6)	QCEmly	Quality Component 6	E;S					
	18 (1)	SEFRdnSc	Socio-economical Factor 1	E;S					
	18 (2)	SEFCsLiv2	Socio-economical Factor 2	E;S					
	18 (3)	SEFScCh	Socio-economical Factor 3	E;S					
	18 (4)	SEFScEq	Socio-economical Factor 4	E;S					
	18 (5)	SEFHmSpt	Socio-economical Factor 5	E;S		**T**	**E**	**Ev**	**S**
	18 (6)	SEFEmp	Socio-economical Factor 6	E;S	**SEQ**	0	2.23	0	2.62
					2.43				
EVQ	14 (7)	QCEvQul	Quality Component 7	Ev					
	18 (7)	SEFTrsp	Socio-economical Factor 7	Ev;S;E					
	19 (1)	AHITPAra	Affordable Housing Integratic	Ev					
	19 (2)	AHICGrdn	Affordable Housing Integratic	E;S;Ev					

19 (3)	AHIBStp	Affordable Housing Integratic	Ev;E					
19 (4)	AHIPrmS	Affordable Housing Integratic	Ev					
19 (5)	AHIPub	Affordable Housing Integratic	Ev;S					
19 (6)	AHIRlWy	Affordable Housing Integratic	Ev;E					
19 (7)	AHIPlgFld	Affordable Housing Integratic	Ev;S					
19 (8)	AHIPrkOS	Affordable Housing Integratic	Ev;S					
19 (9)	AHIHCtr	Affordable Housing Integratic	Ev					
19 (10)	AHIOpAcc	Affordable Housing Integratic	Ev					
19 (11)	AHIGrnSp	Affordable Housing Integratic	Ev					
19 (12)	AHICEnt	Affordable Housing Integratic	Ev;S					
19 (13)	AHICCtr	Affordable Housing Integratic	Ev;E		**T**	**E**	**Ev**	**S**
19 (14)	AHIGenH	Affordable Housing Integratic	Ev		0	2.6	2.56	3.07
				2.89				
					3.14	2.6	4	5

APPENDIX- 5

PROPOSED AFFORDABLE HOUSING QUALITY TOOLKIT

AFFORDABLE HOUSING QUALITY TOOLKIT

SECTION A

NAME OF THE SCHEME: …..…...……
LOCATION OF THE SCHEME: ..…….……
……..……
NAME OF THE DEVELOPER OR ARCHITECT: ……..…….…….
……..……
NAME OF THE ASSESSOR: ……..…….
***DATE OF ASSESSMENT*: ……..…….**

This toolkit consists of 29 parameters (indicators). The range of the scale is from 1-5 or (Very Low Impact to Very High impact). The parameters (indicators) have varying number of criteria. Achievement of the criteria determines the quality weighting for each parameter in any assessment. For instance, a parameter (indicator) with 5 items gets 20%, if it achieves 1 criterion and 40%, if it achieves 2 criteria. Please indicate achievement of each criterion by ticking the box next to it.

CRITERIA FOR AFFORDABLE HOUSING QUALITY KEY PERFORMANCE INDICATORS		**SOURCE**	
A	**TECHNOLOGICAL IMPACT** **This is the ability of Affordable Housing to create a sense of place and have positive effect on the local community and environment as shown by the following indicators:**		
1	➢ ***Innovativeness:*** Innovativeness is the capacity for exploiting new technique(s) or idea(s) in contributing to added value to Affordable housing scheme through any of the following:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for exploring new technique(s) for energy efficiency.	☐	
	▪ Consideration for exploring new technique(s) for water efficiency.	☐	
	▪ Consideration for exploring new technique(s) for cost reduction.	☐	
	▪ Consideration for exploring new technique(s) for using construction materials.	☐	

	▪ Consideration for exploring new technique(s) for wind exploitation	☐	
	▪ Consideration for exploring new technique(s) for waste recycling	☐	
2	➢ ***Design Optimization:*** This is the process of achieving optimal utility of the primary objectives of any Affordable housing projects through design. Affordable housing being assessed is expected to satisfy any or all of the following criteria:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for building orientation such that at least one bedroom window could face east to achieve maximum solar assess during cooler periods in the year.	☐	
	▪ Consideration for locating balconies within building design should be such that it is adjacent to living rooms and between (1m-1.5m) deep.	☐	
	▪ Consideration for balconies should be such that they are not screened with solid walls.	☐	
	▪ Consideration for provision of private open space like patio, porch, deck, balcony or yard.	☐	
	▪ Consideration for traffic calming strategies to slow down cars within the project.	☐	
	▪ Consideration for good acoustics both within and from one dwelling unit to another.	☐	
	▪ Consideration for avoiding large areas of blank wall facing the street.	☐	
3	➢ ***Form and Character:*** This is a process whereby the project's shape satisfactorily adjoins with other buildings in the neighbourhood and also the environment. However the Affordable housing being assessed is expected to satisfy any or all of the following criteria:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)

	▪ Consideration for variety of building forms and roof shapes rather than box-like forms with large unvaried roofs.	☐	
	▪ Consideration for efficient manipulation of buildings to create clusters of units, and variations in height, setback and roof shape.	☐	
	▪ Consideration for relating size and bulk of the structure being assessed to 50-100% of other buildings in the neighbourhood spanning of 200m radius.	☐	
	▪ Consideration for relating the entire height of the assessed structure to that of adjacent structures and of the immediate neighbourhood of 200m radius.	☐	
	▪ Consideration for relating floor-to-floor heights to the neighbouring buildings within 200m radius.	☐	
	▪ Consideration for consistency in the relationship between the first floor of the assessed building and the neighbouring buildings to the street.	☐	
	▪ Consideration for relating the size and bulk of the assessed building to the prevalent scale in other buildings within the immediate neighbourhood of 200m radius.	☐	
4	➢ ***Accessibility:*** This is the ease with which all relevant services or facilities attached to any affordable housing scheme can be reached by all people, goods and services. However the Affordable housing being assessed is expected to satisfy any or all of the following criteria:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for creating architectural 'sense of entry' using additional volumes, void, canopies, threshold detailing, paving etc.	☐	

	▪ Consideration for establishing accessible path of travel from entry to the Affordable housing scheme to the dwelling units as well as other supporting facilities.	☐	
	▪ Consideration for locating parking space at a minimal walking distance of (2m-10m) to the dwelling units.	☐	
	▪ Consideration for locating handicapped and elderly parking with immediate access of less than 5m to respective units.	☐	
	▪ Consideration for avoiding remote parking.	☐	
	▪ Consideration for providing disabled and/or wheelchair access to spaces within Affordable Housing scheme.	☐	
	▪ Consideration for locating visitors drop off and parking within 15m to the main entrance with conspicuous mark of ‘‘all visitor parking space’’.	☐	
5	➢ ***Space:*** The ability of Affordable housing scheme to establish good link between indoor and outdoor spaces and also distribute the available space to the adequacy of intended purpose. As a result the Affordable housing being assessed is expected to satisfy any or all of the following criteria:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for providing clear boundaries between publicly controlled spaces (streets), community controlled spaces (shared open spaces) and privately controlled spaces like patio, porch, deck and balcony within dwelling units.	☐	
	▪ Consideration for either fully or partially enclosing open spaces with buildings to provide clear boundaries.	☐	

	▪ Consideration for linking open spaces so that they form an uninterrupted network of vehicle-free areas.	☐	
	▪ Consideration for provision of minimum space standard for 1 bed 2 person flat as 46sq.m; 2 bed 3-4 person bungalow as 56sq.m; 2 bed 3-4 person bungalow as 66sq.m; 2 bed 4 person house as 73sq.m; 3 bed 5 person house as 86sq.m and 4 bed 7-8 person house as 110sq.m.	☐	
6	➢ ***Uses:*** This is the extent to which the purpose for every facility in any Affordable housing scheme is satisfied through design without undue interference to the other housing facilities.		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for mixed-use development to also include other units of development (e.g. commercial, industrial, academic, vocational etc) in the proportion of 80% Dwelling units to 20% for others units.	☐	
	▪ Consideration for minimizing use and length of double-loaded corridors.	☐	
7	➢ ***Adaptability:*** This is the capacity for Affordable Housing to respond to the changing structural, social, environmental, economical and technological needs.		
	▪ Consideration for the functions of the rooms and other living spaces to be easily convertible without resulting into unwarranted negative impacts.	☐	
	▪ Consideration for upward, downward and sideways extension to be easily achieved from the present state.	☐	

8	➢ ***Style:*** Style is the ability of Affordable housing scheme to be associated with minimum of 60% of the prevailing style(s) within 200m radius of its neighbourhood which may include:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for adopting traces of Victorian, Georgian, Carolingian, Regency, Jacobean, modernism styles etc.	☐	
	▪ Consideration for adopting any other style that could easily blend with the style(s) prevailing within 200m radius of the scheme's neighbourhood.	☐	
9	➢ ***Performance:*** Performance is the ability of Affordable Housing to last for a minimum of 6 months devoid of defects which may arise from either tangible or intangible impacts. These defects may be observed by end-users or assessors in:		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for the structural members of Affordable housing scheme and the adjoining environment to be made good and functioning to full capacity.	☐	
	▪ Considerations for the general plumbing of Affordable housing scheme and the adjoining environment to be made good and functioning to full capacity.	☐	
	▪ Considerations for the electrical fittings of Affordable housing scheme and the adjoining environment to be made good and functioning to full capacity.	☐	
	▪ Considerations for the Ironmongery of Affordable housing scheme and the adjoining environment made to be made good and functioning to full capacity.	☐	

10	➢ ***Engineering:*** This is the capacity for Affordable housing scheme to have its structural framework stable with all its engineering services made good.		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for avoiding engineering appliances that require frequent maintenance.	☐	
	▪ Considerations for locating key support/service areas such as maintenance rooms; mechanical equipment rooms; and trash collection areas.	☐	
	▪ Consideration should be made to provide washing/dryer hook-ups, especially for families and disabled households.	☐	
	▪ Consideration should be made for adequate duct/chase space for both vertical and horizontal duct runs, especially for extractor hood and bathroom fan.	☐	
11	➢ ***Construction Technique:*** This is the degree to which various modern methods of construction (MMC) techniques were applied to reduce cost; construction period and achieve increased quality input to Affordable Housing scheme.		Adapted from CABE(2007); Carmona (2001); Watcher (2006); Home and Community (2008)
	▪ Consideration for choosing construction technique that can easily be maintained by Do-it-yourself (DIY).	☐	
	▪ Consideration for adopting **volumetric** system of construction technique for Affordable housing scheme.	☐	
	▪ Consideration for adopting **panellised** system of construction technique for Affordable housing scheme.	☐	
	▪ Consideration for adopting **Pod** system of construction technique for Affordable housing scheme.	☐	

	▪ Consideration for adopting **lightweight** system of construction technique for Affordable housing scheme.	☐	
	▪ Consideration for adopting **hybrid** system of construction technique for Affordable housing scheme.	☐	
	▪ Consideration for adopting **sub-assembly and components** system of construction technique for Affordable housing scheme.	☐	
B	**SOCIOLOGICAL IMPACT CRITERIA** **This is the capacity of Affordable Housing scheme to create a sense of place and have positive effect on the local community and environment in the following as shown by the following indicator:**		
12	➢ ***Social Inclusiveness:*** This is the degree to which any Affordable housing scheme fosters access to job, school, healthcare, food, social, sporting and cultural facilities to a variety of users, residents and stakeholders irrespective of sex, ethnicity, race, religion or social disposition.		
	▪ Consideration for locating handicapped and elderly parking with immediate access of less than 5m to respective dwelling units.	☐	
	▪ Consideration for mix-use dwellings involving high, middle and low income earners in the proportion 10-15%,20-30%,40-55% respectively.	☐	
	▪ Consideration for access to job for inhabitants within 2000m radius of the dwelling units.	☐	
	▪ Consideration for access to primary/secondary school for inhabitant within 2000m radius of the dwelling units.	☐	

	▪ Consideration for access to healthcare facility for inhabitant within 2000m radius of the dwelling units.	☐	
	▪ Consideration for access to shopping facilities for inhabitants within 500m radius of the dwelling units.	☐	
	▪ Consideration for access to Social cultural or sporting facilities for inhabitant within 1200m radius of the dwelling units.	☐	
13	➢ ***Social Cohesiveness:*** This is the capacity for the scheme to exploit indoor, outdoor spaces and facilities for integration of various ethnic, racial, religious, gender and social differences existing among the inhabitants for the common goal of the entire community.		
	▪ Consideration for the use of outdoor open spaces and facilities to integrate different groups of Affordable housing inhabitants	☐	
	▪ Consideration for the use of indoor spaces and facilities to integrate different groups of Affordable housing inhabitants.	☐	
	▪ Consideration for fair and equitable distribution of public services and facilities to different groups of inhabitants within Affordable housing scheme.	☐	
14	➢ ***Policy-Compliance*** This is the capacity of compliance to planning policy guidelines, codes and bye-laws in developing any Affordable Housing scheme.		Adapted from HCA (2009)
	▪ Consideration for complying with (PPS1) in fostering good designs that contribute positively to making places better for people, while rejecting designs that fail to take the opportunities available for improving the character and quality of an area.	☐	

	▪ Consideration for complying with (PPS3) in ensuring the provision of well-designed new homes, further establishing the government's commitment to good design.	☐	
	▪ Consideration for application of code for 'sustainable homes' in designing and constructing of Affordable housing.	☐	
	▪ Consideration for application of codes for 'Build for Life' in designing and constructing Affordable housing	☐	
15	➢ ***Security/Crime Control*** This is the capacity for Affordable housing scheme to foster security of the inhabitants, their properties and also control crime within its neighbourhood. The affordable housing being assessed is expected to satisfy any or all of the following criteria:		
	▪ Consideration for locating parking space at such a place that allows for casual surveillance of cars from a number of different units.	☐	
	▪ Consideration for provision of access to shared open spaces from individual units, preferable from the kitchen, living room or dining room.	☐	
	▪ Consideration for properly lighting the parking space with lights that are energy efficient and doesn't cause glare or otherwise have negative impact on the surrounding buildings.	☐	
	▪ Consideration for night time lighting plan over shared open spaces should be such that it provides light from variety of sources and match lighting intensity and quality to the use for which it is intended e.g. parking garage or pedestrian path.	☐	

C	**ECONOMICAL IMPACT CRITERIA** **Economical Impact refers to the ability of Affordable Housing to create a sense of place and have positive effect on the local community and environment in the following areas of this research:**		
16	➢ ***Job Creation*** This is the capacity for any Affordable Housing scheme to provide opportunity for meaningful employment of the inhabitants through design, location and/or planning of the scheme. Therefore, Affordable housing schemes are expected in this parameter to achieve some or all of the following criteria.		
	▪ Considerations are for the scheme to include spaces for vocational training	☐	
	▪ Consideration for including office space(s) in some dwelling units.	☐	
17	➢ ***Waste Recycling*** This is the capacity for any Affordable housing scheme to recycle waste generated within the scheme for economic benefit of the inhabitants and reduction of overall cost.		
	▪ Consideration is for provision of an efficient system for recycling about 40-60% of liquid waste within the scheme.	☐	
	▪ Consideration is for tying the waste recycling system to economic viability and sustainability of Affordable housing scheme.	☐	

18	➢ ***Use of Materials*** This is the capacity of Affordable housing scheme to achieve cost reduction without compromising quality in the specification of the building materials for its construction. In this category Affordable housing schemes being assessed is expected to satisfy any or all of the following criteria:		
	▪ Consideration for selecting materials for façade (including foundation walls and roofing) should be such that it is compatible with not less than 50% of good quality buildings in the neighbourhood.	☐	
	▪ Consideration should favour the use of materials that don't require repeated or expensive maintenance.	☐	
	▪ Consideration should favour using materials with high levels of recycled content.	☐	
	▪ Consideration should favour materials that the inhabitants can easily maintain themselves using Do-It-Yourself (DIY).	☐	
	▪ Consideration should favour resilient flooring materials in kitchens, bathrooms, laundries, dining rooms and entrances.	☐	
	▪ Consideration should favour use of healthy building materials for interior finishes and materials, such as carpet, resilient flooring, paint, glues, and cabinets.	☐	
19	➢ ***Water Optimization*** This is the capacity for minimizing the quantity of water usage or increased efficiency in water re-uses within Affordable housing scheme.		
	▪ Consideration should be for the exploitation of cheap or free water supply sources through rain, spring, borehole, rivers etc.	☐	
	▪ Consideration should be focused on adopting cheap techniques for water re-use.	☐	

20	➢ ***Energy Optimization*** This is the capacity for Affordable housing scheme to reduce the cost of energy being used by the inhabitants. However, the Affordable housing being assessed is expected to satisfy any or all of the following criteria:		
	▪ Consideration should be made to provide heavy-duty, energy-efficient appliances and fixtures.	☐	
	▪ Consideration should be for the use of alternative and cheaper sources of energy supply like solar, fossil and wind power.	☐	
21	➢ ***Sustainability*** This is the capacity of Affordable housing scheme to meet with the needs of the present inhabitants without compromising the ability of future inhabitants from meeting their own needs at a considerably low cost.		
	▪ Consideration should be for the use of materials and systems that have the capacity to continually support ecosystem and the inhabitants while creating a safe and affordable environment.	☐	
	▪ Consideration for provision of sustainable scheme using cheap or free sources of energy, water, waste, and agricultural products.	☐	
	▪ Consideration for the use of not less than 60% bio-degradable building materials for construction of Affordable housing schemes.	☐	
	▪ Consideration for provision lot (garden) spaces for sustainable agriculture.	☐	

22	➢ ***Subsidy-free*** This is the capacity of Affordable housing scheme to reduce or totally abstain from financial subsidy from public funds while still remaining cost effective.		
	▪ Consideration for the subsidy of the schemes should be such that it covers not more than 20% of the value of the scheme.	☐	
D	**ENVIRONMENTAL IMPACT CRITERIA** **Environmental Impact refers to the ability of Affordable Housing scheme to create a sense of place and have positive effect on the local community and environment in the following areas of this research:**		
23	➢ ***Zoning*** This is the capacity of locating Affordable housing scheme in such a place as to achieve the following considerations to the benefit of the inhabitants:		
	▪ Consideration for integrating Affordable housing scheme to the greater urban growth.	☐	
	▪ Consideration for location of scheme to easy links with transportation networks.	☐	
	▪ Consideration for location of Affordable housing to foster security of lives and properties.	☐	
24	➢ ***Pollution Control*** This is the capacity of Affordable housing scheme to provide means for the control of both existing and anticipated pollutants within its neighbourhood.		

	▪ Consideration for use of building materials which are environmentally safe.	☐	
	▪ Consideration for providing carbon reduction technique/system within Affordable housing scheme.	☐	
	▪ Consideration for provision of pollution control systems like air purifier.	☐	
25	➢ ***Local Material Contents*** This is the capacity of using local building materials in the construction of Affordable housing scheme.		
	▪ Consideration should be such as to involve 50-100% use of local materials found within 5km radius in building Affordable housing to save cost usually lost in transportation.	☐	
	▪ Consideration should be such as to greatly reduce the use of pre-processed materials from 40%- 0% in building Affordable Housing to save the environment.	☐	
26	➢ ***Health and Safety*** This is the capacity of Affordable housing scheme to maintain good and adequate healthy and safety environment for the inhabitants.		
	▪ Consideration for provision of fire alarms, exits, water hose, fire extinguishers and sprinklers at convenient locations and intervals.	☐	
	▪ Consideration for flood control techniques in Affordable housing scheme.	☐	
	▪ Consideration for location of the scheme away from exposure to materials or chemicals that could be hazardous or injurious to the inhabitants of the scheme.	☐	

	▪ Consideration for the use of construction materials that are predispose to causing harm or deaths to the inhabitants.	☐	
27	➢ ***Waste Disposal*** This is the capacity for proper disposition of unwanted waste from any Affordable housing schemes.		
	▪ Consideration should be made for the path of travel for trash from source to removal area.	☐	
	▪ Consideration should be made to provide screened trash collection areas that are convenient and easy to access from all units.	☐	
28	➢ ***Circulation(Road, Pedestrianization, Parking)*** This is the capacity for Affordable housing scheme to establish strong links between various parts of the scheme through road networks; adjoining pedestrian walkway and parking space(s). However, the Affordable housing being assessed under this parameter is expected to satisfy any or all of the following criteria:		Adapted from Ely (2004)
	▪ Consideration for locating garages, driveways and parking lots to the rare or side of the building being assessed.	☐	
	▪ Considerations for letting majority of other dwelling units of the assessed building face the street instead.	☐	
	▪ Consideration for planting shrubs and trees to soften the overall impact of the parking areas and provide shade and noise reduction.	☐	
	▪ Consideration for locating support facilities like pub, health centre, bus stop, post box, local shop, crèche, community centre and Local Park within 400m or 5 minutes walk from dwelling units.	☐	

	▪ Consideration for locating library, local rail station, school, park and leisure within 800m or 10 minutes walk from dwelling units.	☐	
	▪ Consideration for locating individual parking space at a minimal walking distance of between (2m-10m) from the dwelling units.	☐	
	▪ Consideration for minimizing conflict between vehicles and pedestrians.	☐	
	▪ Consideration for separating bicycle and pedestrian paths from vehicular traffic.	☐	
29	➢ ***Transportation*** This is the capacity of Affordable housing scheme establishing strong, efficient and cheap commune links between itself and the rest of the world through road/rail networks and waterways. However, Affordable housing being assessed under this parameter is expected to satisfy any or all of the following criteria:		
	▪ Consideration for location of the scheme within minimum of 20 minutes walk from the nearest bus station.	☐	
	▪ Consideration for location of the scheme within minimum of 20 minutes walks from the nearest train station.	☐	
	▪ Consideration for location of the scheme within minimum of 20 minutes walks from the nearest boat station.	☐	
	▪ Consideration for design of the scheme to provide for bicycle park.	☐	

SECTION B

This section is a follow up schedule to schemes assessment schedule in section A above. It captures the thematic interpretation of the impact levels for the parameters. Please indicate by ticking one of the five boxes based on computation from above.

TECHNOLOGICAL CRITERIA	VERY LOW IMPACT	LOW IMPACT	AVERAGE MPACT	HIGH IMPACT	VERY HIGH IMPACT
Innovativeness What impact level was achieved if the idea behind the scheme is new, shows ingenuity and contributes to added value?	☐	☐	☐	☐	☐
Design Optimization What impact level was achieved if the projects design was optimally utilized in achieving most Affordable housing primary objectives?	☐	☐	☐	☐	☐
Form and Character What impact level was achieved if the project's shape satisfactorily adjoins with other buildings in its environment?	☐	☐	☐	☐	☐
Access What impact level was achieved if the project is easily accessed from intended ancillary service locations, e.g. bus and train stations, commercial centres, schools, hospital etc?	☐	☐	☐	☐	☐
Space What is the impact level, if the indoor and outdoor spaces are well connected, distributed and adequate for intended purpose?	☐	☐	☐	☐	☐
Uses What is the impact level, if the design adequately satisfies the intended need or purpose for usage?	☐	☐	☐	☐	☐
Adaptability What is the impact level, if the project is suitable to the climate, culture and environment?	☐	☐	☐	☐	☐
Style What is the impact level, if the scheme evokes a style that inspires the inhabitants and compliments the spirit of the place?	☐	☐	☐	☐	☐
Performance What is the impact level, if the general satisfaction level of the inhabitants is good?	☐	☐	☐	☐	☐
Engineering What is the impact level, if the scheme is structurally stable its engineering services made good?	☐	☐	☐	☐	☐
Construction Technique What is the impact level, if the technique of the project's const has added value to its quality?	☐	☐	☐	☐	☐
Energy Optimization What is the impact level, if the project design explored other of energy optimisation?	☐	☐	☐	☐	☐

SOCIOLOGICAL CRITERIA	VERY LOW IMPACT	LOW IMPACT	AVERAGE IMPACT	HIGH IMPACT	HIGHEST IMPACT
Social Inclusiveness What is the impact level, if the project is considerate to the disabled or the aged in the society?	☐	☐	☐	☐	☐
Social Cohesiveness What is the impact level, if the project fosters integration of different strata of the society?	☐	☐	☐	☐	☐
Policy Efficiency What is the impact level, if the project aligns properly with the policy established to foster quality?	☐	☐	☐	☐	☐
Security/Crime Control What impact level was achieved if the project was designed to support the security of the inhabitants and also controls crime within the neighbourhood?	☐	☐	☐	☐	☐

ECONOMICAL CRITERIA	VERY LOW IMPACT	LOW IMPACT	AVERAGE IMPACT	HIGH IMPACT	VERY HIGH IMPACT
Job Creation What impact level was achieved in jobs creation for the inhabitants within Affordable housing project?	☐	☐	☐	☐	☐
Waste Recycling What impact level was achieved by any technique applied to recycle waste generated within the Affordable housing project?	☐	☐	☐	☐	☐
Use of Materials What impact level does the choice of construction materials for the project offer to its economic viability and durability?	☐	☐	☐	☐	☐
Water Optimization What impact level was achieved by any technique applied to minimize water consumption in the project?	☐	☐	☐	☐	☐
Energy Optimization What impact level was achieved by any technique applied to minimize energy consumption in the project?	☐	☐	☐	☐	☐
Sustainability What impact level does the project offer in being able to meet the needs of the present inhabitants without compromising the ability of future inhabitants from meeting their own needs?	☐	☐	☐	☐	☐
Subsidy-free What impact level was achieved by the project in abstaining from any form of financial subsidy?	☐	☐	☐	☐	☐

ENVIRONMENTAL CRITERIA	VERY LOW IMPACT	LOW IMPACT	AVERAGE IMPACT	HIGH IMPACT	VERY HIGH IMPACT
Zoning What impact level was achieved in locating the project to a particular zone?	☐	☐	☐	☐	☐
Pollution What impact level was achieved in addressing issues of pollution within the scheme?	☐	☐	☐	☐	☐
Local Material Contents What impact level was achieved by the developer using building materials in the locality for construction of the schemes?	☐	☐	☐	☐	☐
Health and Safety What is the impact level of the scheme in promoting health and safety of the expected inhabitants?	☐	☐	☐	☐	☐
Waste Disposal What impact level was achieved in properly disposing of unwanted waste from the schemes' environment?	☐	☐	☐	☐	☐
Circulation (Road, Pedestrianization, Parking) What impact level was achieved while linking various parts of the scheme through road networks; adjoining pedestrian walkway and parking space?	☐	☐	☐	☐	☐
Transportation What impact level was achieved in properly linking the scheme with various transportation modes like the rail, tram, coach, and cab stations?	☐	☐	☐	☐	☐

APPENDIX- 6

PUBLICATIONS; CONFERENCE AND SEMINAR PRESENTATIONS

CONFERENCE PUBLICATIONS

- *Okehielem, N., Georgakis, P., Chinyio, E. and Nwagboso, C. (2007) Affordable Housing: Obstacles of delivery through off-site construction, Proceedings of The Third Scottish Conference for Postgraduate Researchers of the Built and Natural Environment, Glasgow Caledonia University, November 20-22, pp 381-390.*

- *Okehielem, N., Chinyio, E., Gameson, R. and Nwagboso, C. (2007) Grounded Theory Approach Towards Assessment of Affordable Housing in UK, Proceedings of Association of Researchers in Construction Management (ARCOM) Doctoral Workshop, University of Wolverhampton, pp. 19-25*

PRESENTATIONS/ SEMINARS

- *Okehielem, N., Chinyio, E., Gameson, R. and Nwagboso, C. (2007) Benchmarking: Key To Improved Affordable Housing Delivery in England, American Real Estate Society (ARES), San Francisco.*

- *Okehielem, N., Chinyio, E., Gameson, R. and Nwagboso, C. (2006)The State of Affordable Housing Quality in UK, WCAEBE 2006 International Conference, Millenium Point Birmingham, 2nd-4th Oct 2006.*

- *Okehielem, N., Chinyio, E., Gameson, R. and Nwagboso, C. (2008) Benchmarking In the UK Built Environment, School of Engineering and Built Environment, University of Wolverhampton.*